NEMS CLARKE CO. (VITRO CORP.)

SPECTRUM DISPLAY UNITS

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# INSTRUCTION BOOK
# FOR
# SPECTRUM DISPLAY UNITS

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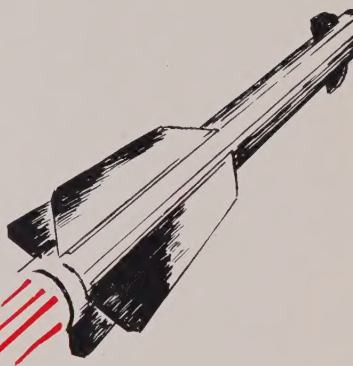

NEMS CLARKE CO.

919 JESUP BLAIR DRIVE • SILVER SPRING, MARYLAND

A DIVISION OF Vitro CORPORATION OF AMERICA

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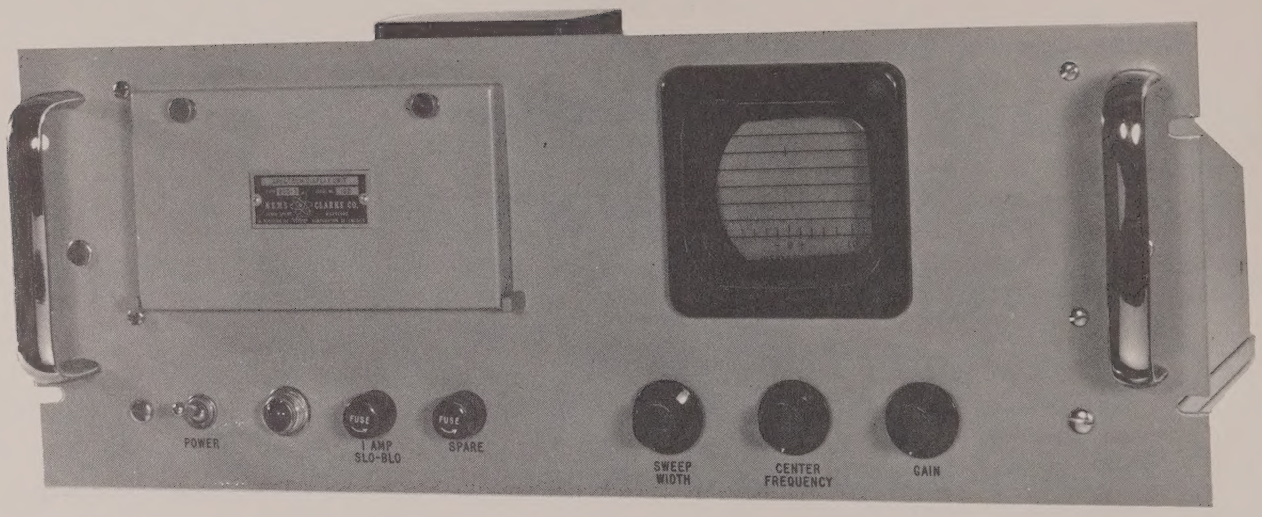



*Figure 1. Spectrum Display Unit, Front View*

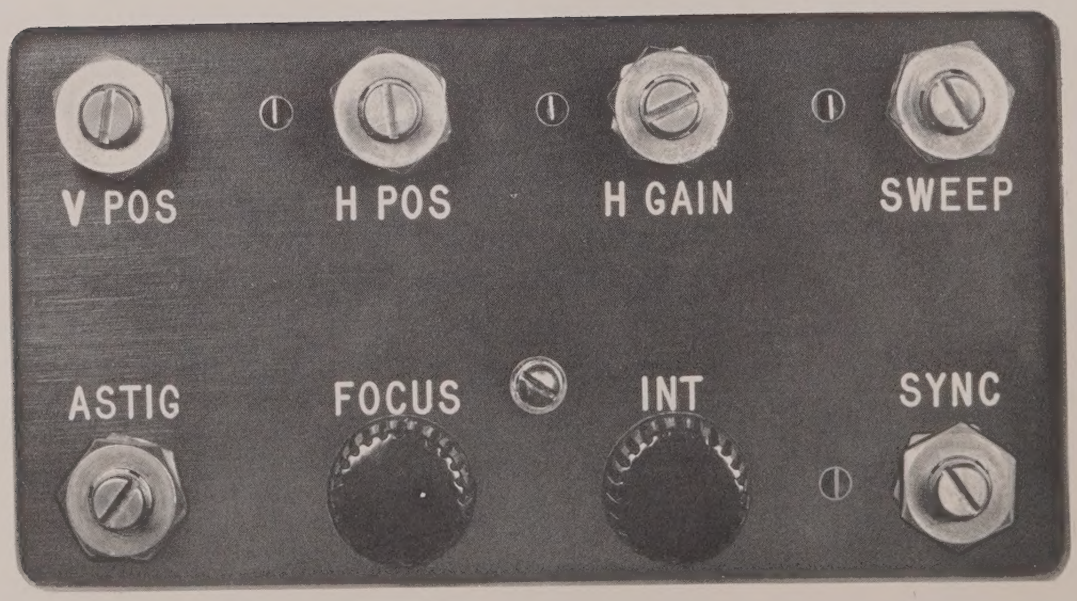



*Figure 2. Cathode-Ray Tube Adjustment Control Sub-Panel*

# SECTION 1

# INTRODUCTION AND DESCRIPTION

1-1. THE SPECTRUM DISPLAY UNIT, Figure 1, is an instrument designed specifically for use with Telemetering Receivers to determine the frequency, relative amplitude and type of modulation of a signal being received. The bandwidth of the Spectrum Display Unit is 2 MC or 3 MC displayed visually on a calibrated cathode ray tube screen. The cathode ray tube used is capable of showing all signals within a range of 1 MC or 1.5 MC on either side of the tuned frequency. The bandwidth is adjustable by means of a SWEEP WIDTH control. Maximum bandwidth is normally used when searching for signals around the desired frequency; a narrow bandwidth is used when evaluating missile signals.

The input signal for the SDU comes from an auxiliary IF output on the receiver. The usable bandwidth at the SDU output of the receiver is considerably less than the desired sweep width of the SDU, so, a broadband amplifier has been built into the SDU to compensate for the narrow bandwidth. Each receiver type requires a different compensation to produce a relatively flat amplitude response over the frequency range corresponding to maximum sweep width. Table 2 shows the proper SDU Type for the various Models of Telemetry and Special Purpose Receivers.

Mounted on the front panel, in addition to the cathode ray tube screen, are the following operating controls: a toggle POWER SWITCH, SWEEP WIDTH control knob, CENTER FREQUENCY control knob and GAIN control knob. There are also a pilot-light, an operating fuse, and a spare fuse. Under the hinged cover, at the upper left hand corner of the panel, is a sub-panel (Figure 2) containing six screw-driver controls and two manual control knobs for adjusting the cathode-ray tube image. Screw-driver controls are: vertical position (V-POS), horizontal position (H-POS), horizontal gain (H-GAIN) SWEEP, astigmatism (ASTIG), and synchronization (SYNC). Manual controls are: FOCUS and intensity (INT). The power and coaxial inputs are located on the rear apron of the chassis. For the electrical characteristics of the Spectrum Display Unit, see Table 1.

All models of the SDU are identical in physical appearance, the difference being in the performance characteristics and components of the first IF amplifiers. Overall dimensions are: 19 inches wide by 15 inches deep by 7 inches high. The net weight is 25 lbs.; shipping weight, approximately 50 lbs. The equipment is supplied with a rigid perforated cover when it is to be used on a table or shelf, but it is designed for mounting in a standard 19 inch relay rack. Provisions are made for the installation of Grant hardware, consisting of bracket and slide assemblies which permit the unit to be withdrawn from the rack and tilted at either 45 or 90 degrees to facilitate servicing. Signal input and power input connectors are located on the rear apron of the chassis. A type BNC coaxial connector is used for signal input. A "twist-lock" receptacle with a grounding terminal is used for the power input.

The mechanical and electrical design of the unit is such that the various models are identical with the exception of the first IF assembly, the cathode-ray tube scale, and the adjustment of certain controls which set the reactance tube sweepwidth and linearity. Subchassis construction has been used extensively in the Spectrum Display Units to facilitate replacement of the interchangeable IF amplifier chassis, and as an aid in servicing the units. One sub-chassis consists of the first and second IF Amplifiers, 21.4 MC or 30.0 MC; a second sub-chassis contains the local oscillator, reactance tube, and mixer; a third chassis consists of the 4.3 MC IF Amplifier strip. The remainder of the circuitry is located on the main chassis with components mounted on terminal boards whenever practicable.

TABLE 1. ELECTRICAL AND PERFORMANCE CHARACTERISTICS—SPECTRUM DISPLAY UNITS

| *Specifications* | *Type 200* | *Type 300* |
|---|---|---|
| Maximum Sweep Width | 2 MC | 3 MC |
| Input Center Frequency | 21.4 MC or 30.0 MC | 21.4 MC or 30.0 MC |
| Second IF Amplifier Frequency | 4.3 MC | 4.3 MC |
| Sensitivity for full deflection: | 5 microvolts to receiver | 5 microvolts to receiver |
| Resolution* | Approximately 20 KC | Approximately 20 KC |
| Power Input | 117 volts, 50–60 CPS | 117 volts, 50–60 CPS |

*Two equal-amplitude signals 20 KC apart will appear as two separate pips with the point of intersection being at least 6 db down.

*Note:* A suffix number is added to the "type number" to denote the type of receiver with which the SDU is to operate; i.e., SDU-200-3 indicates an SDU to be used with a receiver having an IF operating frequency of 30 MC.

TABLE 2. LIST OF SPECIAL PURPOSE RECEIVERS AND SPECTRUM DISPLAY UNIT REQUIRED

| *Receiver Model Number* | *SDU Type Number and Suffix* | | | |
|---|---|---|---|---|
| | *Type 200* | | *Type 300* | |
| Input Center Frequency: | 21.4 MC | 30.0 MC | 21.4 MC | 30.0 MC |
| 1301, 1301-A<br>1302, 1302-A | 200-2<br>200-2 | | | |
| 1400, 1400-A<br>1401, 1401-A, 1401-B | | 200-3<br>200-3 | | |
| 1401-R | | 1401-SDU | | |
| 1402<br>1403<br>1410, 1410-A<br>1411, 1411-A<br>1412<br>1420, 1421<br>1430, 1431, 1432, 1433 | | 200-3<br>200-3<br>200-3<br>200-3<br>200-3<br>200-3<br>200-3 | | |
| 1500, 1501-A, 1502, 1502-A<br>1503, 1503-A<br>1509, 1510, 1511, 1512 | 200-2<br>200-2<br>200-2 | | | |
| 1670-E, 1670-F | 200-1 | | 300-1 | |
| 1670-G, 1670-J | 200-2 | | | |
| 1671, 1672 | 200-1 | | 300-1 | |
| 1673, 1674 | 200-2 | | | |
| 1700-A Series | 200-2 | | 300-5 | |
| 2100 | | | 300-4 | |
| 2301 | 200-2 | | | |
| 2401 | 200-2 | | | |
| 2701 | 200-1 | | | |

# SECTION 2

## THEORY OF OPERATION

2-1. GENERAL. From the block diagram, Figure 3, it can be seen that the Spectrum Display Unit is a complete superheterodyne receiver in itself. The first section, which can be considered a radio-frequency amplifier, receives a 21.4 or 30.0 MC signal from the first converter in the telemetry receiver. Since the bandwidth from the receiver, at the SDU output, is considerably narrower than the sweep width desired, a broad-band amplifier with frequency response compensation has been built into the Spectrum Display Unit to spread the band. Each type of receiver requires a different compensation setting to produce a relatively flat amplitude response over the range corresponding to the maximum sweep width of the instrument. The Spectrum Display Unit has a first amplifier with bandpass characteristics inverse to the bandpass characteristics of the receiver, that is, it amplifies when the receiver attenuates and vice-versa. Consequently, when the two units are used together, the over-all bandpass characteristics become uniform.

The input of the bandpass amplifier is connected to the plate circuit of the first detector of the receiver. A reasonably constant overall response of two megacycles is obtained at the connector output. Signals from the radio-frequency bandpass amplifier are mixed with the signal from the FM Oscillator. The frequency of the oscillator varies in step with a sawtooth voltage applied to the grid of a reactance tube included in the tuning circuit of the oscillator. The oscillator is frequency modulated over a range extending equally above and below a mean frequency at a fixed rapid rate, the mean frequency being the difference between the intermediate frequencies of the receiver and the Spectrum Display Unit. Signals from the output connector pass through a sharply tuned I.F. Amplifier, are rectified, and subsequently amplified by a video type amplifier. Then they are fed to the vertical deflecting plates of the cathode ray tube. Thus the movement of the beam in the tube is synchronized with the tuning of the oscillator. The signals appear in rapid succession and no more than one signal appears on the screen at any one instant. However, due to persistance of the screen image, all the signals seem to appear at the same time. This must be fully understood by the operator to assure correct interpretation of the visual display.

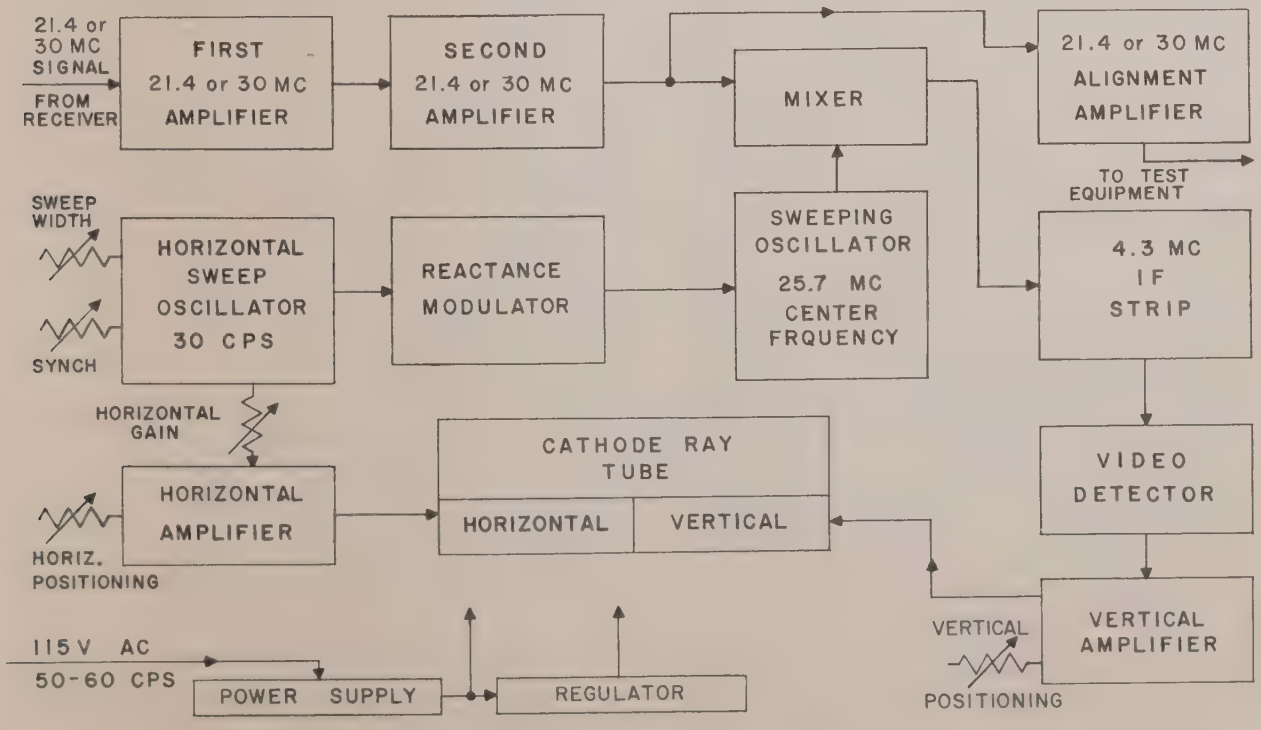



*Figure 3.—Block Diagram, Spectrum Display Units*

2-2. INPUT SECTION. The input to the Spectrum Display Unit is taken from the first converter in the Receiver. The 21.4 or 30.0 megacycle signal is amplified in the first I.F. section of the SDU which consists of three stages: the first stage, tube V-201, is single-tuned by a tuned tank, and capacitively coupled to the second stage, tube V-202. The second stage is double-tuned by the capacitively coupled transformers T-201A and T-201B. Transformer T-201B is directly coupled to the third tube, V-203. The signal to the second I.F. section is taken from the input of the third amplifier through connector J-203. The output of the third tube, V-203, is rectified and used for alignment purposes. Gain of the first I.F. section is controlled by resistor R-109 which adjusts the cathode bias on tube V-201.

2-3. LOCAL OSCILLATOR AND REACTANCE TUBE. The local oscillator, V-302, generates a frequency of 25.7 megacycles. A capacitor, C-311, connected to coil Z-301 in the tuned grid circuit of the local oscillator is used for manual adjustment of the SDU center frequency.

The Sweep Width control resistor, R-112, regulates the amplitude of the saw-tooth wave. When the voltage is reduced to zero the reactor no longer sweeps, and the oscillator operates at its mean frequency. The oscillator output is inductively coupled by the transformer T-301 to tube V-303. The secondary coil of the transformer connects to the first grid of the pentagrid mixer V-303 where it combines with the 30 megacycle signal from the first I.F. amplifier. The difference in frequency of 4.3 megacycles appears at J-302, the output of the mixer section.

2-4. SWEEP VOLTAGE GENERATOR AND AMPLIFIER. The sweep voltage generator consists of dual triode, V-104, and its associated components. Half of V-104 is used for a blocking oscillator and the other half as a cathode follower. The frequency of the sweep generator is controlled by the blocking oscillator circuit. T-102 is the blocking oscillator transformer. Capacitor, C-106, and resistors, R-110 and R-111, control the oscillator timing. Resistor R-111, the SYNC control, is used to synchronize the blocking oscillator frequency with that of the power line. The saw-tooth sweep voltage waveform is generated by capacitor C-108 and resistor R-118, while capacitor C-108 charges during the time in which the blocking oscillator section of V-104 is nonconducting. The plate current pulse of the blocking oscillator tube acts to discharge capacitor C-108 completing the saw-tooth wave shape

The saw-tooth voltage across capacitor C-108 is applied to the grid of the cathode follower section of tube V-104. The cathode output voltage is applied to the C.R.T. horizontal deflecting plates through tube V-105 to provide the base line. The output is also applied to the reactance tube V-301 for the purpose of sweeping the oscillator frequency.

In the cathode follower circuit of tube V-104, resistor R-116 is the horizontal gain control, adjustment of which determines the physical length of the base line. Resistors R-112 and R-114 are the SWEEP WIDTH and SWEEP controls respectively; R-112 is for fine adjustment of sweep voltage, while R-114 is used for coarse adjustment. Sweep Width and Sweep refer to the frequency range covered by the SDU. Dual triode tube, V-105, is used as a cathode-coupled push-pull horizontal sweep amplifier. Its output is directly coupled to the C.R.T. horizontal deflecting plate. Horizontal positioning is performed by adjustment of resistor, R-124, which controls the bias on half of tube V-105.

2-5. 4.3 MC I.F. AMPLIFIER SECTION. The second I.F. section consists of three stages of I.F. amplification. All interstage transformers are tuned to 4.3 megacycles and are adjusted for critical coupling. The gain is controlled by resistor R-109 which also controls the gain of the first I.F. section.

2-6. DETECTOR AND VERTICAL DEFLECTION AMPLIFIER. One half of tube V-404 is used as the detector. The other half is not used and is grounded. Direct coupling is used between the diode detector and tube V-107, a video amplifier similar to the horizontal sweep amplifier. The vertical deflection plates of the cathode ray tube are directly coupled to the video amplifier. Vertical positioning is accomplished by adjustment of resistor R-136 which controls the bias on half of tube V-107.

2-7. CATHODE-RAY TUBE. The cathode-ray tube, V-106 consists of a number of elements operating at high potentials. When the potentials are applied in the proper ratio, they cause the electrons emitted from the cathode to be accelerated to a high velocity and focused into a beam. The beam strikes the fluorescent coating on the "screen" of the tube and glows as a "dot". There are two sets of plates in the cathode-ray tube, one set for horizontal deflection of the "dot" and the other set for vertical deflection. Varying voltages applied to the plates cause the "dot"to be deflected to varying positions on the screen. The deflection is so rapid that the dots on the screen appear as a continuous pattern. Performance of the cathode-ray tube is regulated by manual (screwdriver) adjustment of the following resistors:

R-130 controls the brightness (intensity) of the image on the screen and is labeled "INT".

R-133 is used to control the sharpness of the trace, and is labeled "FOCUS".

R-129, labeled "ASTIG" (astigmatism) further sharpens the trace.

R-136, "V-POS" controls the vertical position of the trace.

R-124, "H-POS" controls the horizontal position of the trace.

# SECTION 3

# OPERATION

3-1. INSTALLATION. Although the Spectrum Display Unit is designed for mounting in a standard 19 inch relay equipment rack, it may be used on a table or shelf. The unit is supplied with a rigid protective cover for use when it is installed outside of an equipment rack.

(a) Select a well ventilated location to provide adequate heat dissipation.

(b) Plug in the power cord supplied to J-101 and a 115-V, 60-C, ac. outlet.

(c) Connect the unit to the SDU output of the receiver to be checked.

3-2. OPERATION OF THE SPECTRUM DISPLAY UNIT.

(a) Turn on the SDU and the receiver to be used for Spectrum Display checking.

(b) Turn on the SDU and wait for the base line to appear.

(c) Turn the GAIN control up about half way.

(d) Tune the receiver slowly until one or more signals move across the screen of the cathode-ray tube.

(e) Tune in any station on the receiver. The signal should appear exactly in the center of the scale directly over the ZERO (0) point of the screen calibration. For best results, it is advisable to adjust the mean frequency of the SDU oscillator to give a signal which remains in the center of the screen regardless of the position of the SWEEP WIDTH control. This adjustment is accomplished by turning the SWEEP WIDTH control fully clockwise, then centering the deflection peak by rotating the CENTER FREQUENCY knob to left or right. Gradually turn the SWEEP WIDTH control counter-clockwise meanwhile maintaining the peak centered with the CENTER FREQUENCY control until the base of the pip curve occupies the entire screen width. Now, turn the SWEEP WIDTH control fully clockwise. The peak of the curve should remain at the zero point on the screen; if not, adjust the HORIZONTAL POSITION control until the curve is centered. Once set, the CENTER FREQUENCY control should rarely need to be readjusted, however, incorrect adjustment of the CENTER FREQUENCY will result in misalignment of the SDU with the receivers.

3-3. INTERPRETATION OF SIGNALS. With a little experience, the operator will be able to recognize visually the character of the various types of signals without the need of listening to them. However, the receiver must be adjusted properly if good results are to be obtained.

(a) A Constant carrier appears as a deflection of fixed height.

(b) An amplitude-modulated carrier appears as a deflection of variable height. Voice or music modulaion causes the carrier to vary irregularly.

A constant tone modulation of low frequency will produce a series of convolutions varying in height, their number being determined by the modulation frequency. As the modulation frequency increases, the convolutions move toward the two sides of the deflection as the sidebands tend to become visible. When the modulation frequency is increased, it becomes possible to separate the two side-bands by reducing the sweep width. The higher the frequency of modulation, the further away these sidebands will move from the center deflection representing the carrier. Note that, due to the imperfect equalization of the receiver, the two side-bands may appear unequal in height, even though they are of equal strength. Their relative heights may vary as the receiver is tuned and as the deflection moves from one end of the screen to the other.

(c) Single side-band modulation appears as two carriers of slightly different frequency. (See (h) below on signal interference).

(d) A frequency-modulated carrier appears as a carrier which is "wobbling" sideways.

(e) A speech or music modulation FM signal appears as a multiplicity of deflections spreading over a variable band-width.

(f) A CW signal appears and disappears in step with the keying of the transmitter. During the moments when the signal is off, the frequency sweep axis closes at the base of the signal. A radio operator used to reading CW signals on phones can, with little practice, read such signals directly off the screen. In very rapidly keyed signals the deflection and the base line are seen simultaneously.

(g) An MCW signal appears like a CW signal of periodically varying height. If the modulation rate is high, side-bands will appear as explained above.

(h) Signal Interference: Two signals which are so close in frequency as to cause aural interference (beats) may appear on the screen as a single deflection varying in height as with a modulated signal. As the frequency separation is increased, the deflection appears

as if modulated on one side only. Further increase of frequency will cause a "break" in the apex of the deflection. By reducing sweep width of the SDU, the respective deflections will separate gradually.

(i) Transient disturbances, generally received as noises in the receiver, are of two types; periodic and random. Periodic transients, such as produced by automobile ignition systems, motors, vibrators, buzzers, etc., appear as signals moving along the frequency sweep base line in one direction or another.

Thus, an automobile which is accelerating, will produce a set of deflections which may move first in one direction, slow down, stop, and then move in an opposite direction. This is caused by the fact that the SDU is sweeping at a fixed rate (20 to 40 times per second), whereas the random type disturbances occur at a variable rate. The image stands still on the screen only when the two signals are synchronized. If the transient disturbance is synchronized with the 60 cycle line, the "noise" appears as a fixed signal which, however, does not move on the screen when the receiver is tuned, but only varies in height. Such deflections may appear like amplitude modulated signals or like steady carriers. (See (m) below, on diathermy apparatus). Random transients, such as "static", appear as irregular deflections and flashes along the whole frequency sweep axis.

(j) Tube noise, due to too great an amplification of the receiver, or of the SDU, or both, appears as varying irregularities along the frequency sweep axis. Proper adjustment of the gain controls should reduce or eliminate this disturbance.

(k) Images. If the receiver allows "images" to pass, they will be distinguishable from normal signals by the fact that they move in the opposite direction with respect to normal signals on the screen when the receiver is being tuned. Such images are most likely to appear in the higher frequency ranges.

(l) Harmonics produced in the receiver by the beat of very strong signals with harmonics of the oscillator, will be distinguishable from other signals by the fact that they move on the screen more rapidly than the normal signals while tuning (twice as fast for second harmonic spurious signals). Generally, a reduction in the gain of the receiver will eliminate harmonics.

(m) Diathermy apparatus using an unfiltered power supply will produce a periodic disturbance causing deflections to appear on certain portions of the screen. This is because such equipment emits a pulsating signal synchronous with that of the power line. On the other hand, the SDU is sweeping the spectrum synchronously with the line, but at a lower frequency, and only when a certain phase relationship exists, is it possible for the SDU to receive those periodic pulses.

(n) Spurious Signals. If the signal strength exceeds a certain value, the deflection caused by any signal breaks up into a series of parallel deflections somewhat similar to side-bands. A reduction in the gain of the SDU will eliminate this type of distortion.

TABLE 3. SEMI-CONDUCTOR AND TUBE COMPLEMENT, SPECTRUM DISPLAY UNIT

| *Circuit Symbol* | *Tube Type* | *Function* |
|---|---|---|
| CR-101, 102 | 026-30H-QC | Rectifier: Selenium half-wave 315 V DC, 5 ma output. Voltage doubling rectifier. |
| CR-201 | CK-705/IN66 | Rectifier: Germanium, 60V continuous reverse working voltage, 5 ma at +1 volt forward current. |
| V-101 | 5Y3GT | Rectifier |
| V-102 | OA2 | Voltage Regulator for 2nd IF Amplifier, Oscillator, reactance modulator, and frequency converter. |
| V-103 | OA2 | Voltage Regulator for 1st IF Amplifier, Sweep voltage generator. |
| V-104 | 12AU7 | Sweep Voltage Generator |
| V-105 | 12AT7 | Horizontal Deflection Amplifier |
| V-106 | 3RPIA | Cathode Ray Indicator |
| V-107 | 12AT7 | Vertical Deflection Amplifier |
| V-201 | 6BA6 | 1st IF Amplifier |
| V-202 | 6AU6 | 1st IF Amplifier |
| V-203 | 6AU6 | 1st IF Amplifier (Alignment Amplifier) |
| V-301 | 6AH6 | Reactance Modulator |
| V-302 | 6AU6 | Local Oscillator |
| V-303 | 6BE6 | Mixer |
| V-401 | 6BA6 | 2nd IF Amplifier (1st stage) |
| V-402 | 6BA6 | 2nd IF Amplifier (2nd stage) |
| V-403 | 6AU6 | 2nd IF Amplifier (3rd stage) |
| V-404 | 6AL5 | Video Detector |

# SECTION 4

# MAINTENANCE

**WARNING**

This equipment employs voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised while working with this equipment.

4-1. TROUBLE SHOOTING, GENERAL. When the SDU does not operate properly, a complete visual inspection should be made. The signal and power input cables should be properly connected. The tubes should be inspected to insure that they are properly seated in their sockets. All tubes should show the red glow of the tube heater. Lack of this indication of an operating tube heater, should be followed by

**TABLE 4. TUBE VOLTAGE CHART, SPECTRUM DISPLAY UNITS**

*Note:* 115V AC INPUT. All measurements taken with RCA WV-97A VTVM to chassis ground.
Gain control set at maximum: no input.
Sweep width set at maximum.

| *Tube* | *Type* | *Pin Number* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* |
| V-101 | 5Y3GT | | 340 | | 315AC | | 315AC | | 340 | |
| V-102 | OA2 | 150 | | | | 150 | | 0 | | |
| V-103 | OA2 | 150 | | | | 150 | | 0 | | |
| V-104 | 12AU7 | 150 | 44 | 49 | 6.0AC | 6.0AC | 44 | −21 | 0 | 0 |
| V-105 | 12AT7 | 165 | 45 | 50 | 6.0AC | 6.0AC | 160 | 46 | 50 | 0 |
| V-106 | 3RPIA | (See below) | | | | | | | | |
| V-107 | 12AT7 | 200 | 49 | 53 | 6.0AC | 6.0AC | 150 | 50 | 53 | 0 |
| *21.4 MC (Type A) IF Chassis* | | | | | | | | | | |
| V-201 | 6BA6 | 0 | Gnd | 6.0AC | Gnd | 130 | 76 | 1.3 | | |
| V-202 | 6AU6 | 0 | Gnd | 6.0AC | Gnd | 133 | 90 | 1.4 | | |
| V-203 | 6AU6 | 0 | Gnd | 6.0AC | Gnd | 135 | 97 | 1.5 | | |
| *30.0 MC (Type B) IF Chassis* | | | | | | | | | | |
| V-201 | 6BA6 | 0 | 0 | 6.1AC | 0 | 140 | 86 | 1.35 | | |
| V-202 | 6AU6 | 0 | 0 | 6.1AC | 0 | 144 | 102 | 1.4 | | |
| V-203 | 6AU6 | 0 | 0 | 6.1AC | 0 | 145 | 100 | 1.53 | | |
| V-301 | 6AH6 | 0 | 0 | 6.0AC | 0 | 190 | 148 | 2 | | |
| V-302 | 6AU6 | −3.5 | 0 | 6.0AC | 0 | 195 | 146 | 0 | | |
| V-303 | 6BE6 | −9.1 | 1.1 | 6.0AC | 0 | 140 | 104 | 0 | | |
| V-401 | 6BA6 | 0 | 0 | 6.0AC | 0 | 190 | 80 | 1.3 | | |
| V-402 | 6BA6 | 0 | 0 | 6.0AC | 0 | 190 | 82 | 1.2 | | |
| V-403 | 6AU6 | 0 | 0 | 6.0AC | 0 | 140 | 99 | 1.5 | | |
| V-404 | 6AL5 | 50 | 0 | 4.65AC | 0 | 0 | 0 | 50 | | |

***WARNING—Beware of Dangerous Voltages in the Cathode-Ray Tube Socket.***

| V-106 | 3RPIA | (Remove cover from socket to measure). | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Pin No.* | *1* | *2* | *3* | *4* | *6* | *7* | *8* | *9* | *10* | *12* |
| *Voltage* | * | −760 | −730 | −500 | 160 | 165 | 172 | 200 | 150 | * |

* Voltage between pins 1 and 12 is 6.1V AC (Pins 5 and 11 not used).

replacement of the tube. If none of the tube filaments are operating and the pilot lamp does not light, the wire connecting the fuse F-101 is likely to be broken. It often happens that vibration during transportation of the equipment will break the fuse wire in one of the end caps, and a superficial visual inspection would not indicate the defective condition of the fuse connection.

4-2. INOPERATIVE SDU. If there is no indication on the face of the cathode-ray tube, the equipment is considered to be inoperative. This may be caused by maladjusted controls, lack of necessary operating voltages, or defective cathode-ray tube. Advancing the intensity (INT) control, R-130, will cause the trace to appear, if this control has been retarded enough to cause extinction of the tube trace.

The controls marked "V-POS" (R-136) and "H-POS" (R-124) may be adjusted to determine if the trace has been moved completely off the face of the tube by mal-adjustment of these controls. The V-101 rectifier tube should be replaced by a new one to determine if a defective rectifier tube is depriving the unit of operating voltage. If these manipulations do not produce a spot or trace on the tube, the operating voltage of the tube should be checked in accordance with Table 4.

4-3. IMPROPERLY OPERATING SDU. Since defective vacuum tubes are the most prevalent cause of improper equipment operation, systematic tube substitution often results in quick repair of such equipment. A horizontal trace with no vertical "pips" calls for adjustment of the "GAIN" control R-109 to the maximum clockwise position. If this produces "grass" on the trace, it is likely that no input signal is being received. Failure of any of the tubes, V-101, V-102, V-103, V-104, V-107, V-201, V-202, V-302, V-303, V-401, V-402, V-403, or V-404 would prevent a vertical deflection. Replacement of tubes here will determine whether this is the cause of the trouble. A vertical line trace indicates no horizontal sweep. Tubes V-104 or V-105 should be replaced to determine if they are the source of the trouble.

A horizontal trace which shifts vertical position when a signal is tuned in would indicate that tube V-107 or its associated circuitry is at fault. If this procedure does not locate the source of trouble, then the tube-pin-voltages should be checked against the tube voltage table, Table 4. Any appreciable deviation from the listed values should indicate the circuitry at fault. A check of associated circuit components by the schematic diagram, Figures 11 to 11B should indicate the defective component. Any further servicing will necessitate reference to the maintenance section of this manual.

4-4. REPLACEMENT OF CATHODE-RAY TUBE IN SDU.

A. Removal of Cathode-Ray Tube

(a) Pull off CRT socket from tube base.

(b) Remove the 4 screws that hold bezel on front panel. Lift off the bezel and the calibrated green filter screen from the front panel.

(c) Pull rubber boot off the face of the CRT.

(d) Loosen the base clamp of CRT. Remove tube through the front panel. The magnetic shield remains attached to the panel.

B. Installation of CRT:

(a) Insert the tube through front panel, into the magnetic shield.

(b) Put rubber boot over face end of CRT, positioned so that rectangular boot opening will be aligned with the bezel and filter screen.

(c) Connect the socket to the base of the tube.

(d) Install bezel and green filter screen on the panel and tighten the 4 mounting screws. Align the boot opening with the filter screen by pulling CRT away from bezel and rotating base of tube.

(e) With the SDU turned on and adjusted for a well defined base line, check the alignment of the CRT with that of the filter screen. Rotate the CRT, if needed, by turning its socket until the base line is parallel with the horizontal lines on the filter screen. Press forward lightly on the CRT face while rotating in order to prevent simultaneous rotation of the boot.

(f) After aligning the base line with the filter screen, press forward lightly on the tube base and tighten the base mounting clamp.

4-5. ALIGNMENT PROCEDURE

Before alignment of the SDU is attempted, the instrument should be allowed to "warm up" for at least one-half hour.

A. SWEEP GENERATOR AND CATHODE-RAY TUBE ALIGNMENT

Equipment required:

One oscilloscope, DuMont 304-A or equivalent.

PROCEDURE:

(1). Connect the vertical amplifier of the oscilloscope between pin 3 of Tube V-104 and ground.

Connect the horizontal amplifier to pin 5 of V-104 tube.

(2). Set the SYNC control fully clockwise. Turn it slowly counter-clockwise and note where the scope pattern locks in, displaying two cycles of a sine wave positioned vertically. Continue turning the control counter-clockwise until the pattern drops out of sync. Set SYNC control approximately midway between these two positions.

(3). Disconnect the oscilloscope before proceeding with the next step.

B. 4.3 MC I.F. AMPLIFIER ALIGNMENT. This unit has a center frequency of 4.3 megacycles.

Equipment required:
One VTVM (Vacuum Tube Voltmeter)
One Signal Generator, Measurements Corp. #65-B.

PROCEDURE:

(1). Connect a short clip lead across capacitor C-434 to short out the D-C voltage that is normally in series with the detector output.

(2). Connect the VTVM from grid pin 2 of tube V-107 to ground.

(3). Set the SDU GAIN control to maximum, clockwise.

(4). Remove tube V-302 from socket and leave out until needed for oscillator alignment.

(5). Connect the Signal Generator to J-301 and set its frequency to 4.3 mc, adjust its output as required to produce an indication on the VTVM, not to exceed 5 volts.

(6). Install bottom covers on both IF strips. Adjust transformers T-302-A and B. T-401-A and B, T-402-A and B, and T-403-A and B for maximum output and reducing generator output to maintain 5 volts or less on the VTVM until no further improvement can be achieved.

(7). Remove clip lead from the C-434 Capacitor.

C. REACTANCE TUBE AND LOCAL OSCILLATOR ALIGNMENT.

Equipment required:
One Signal Generator, Hewlett-Packard #608-A.
One Signal Generator, Measurements Corp. #65-B
One D-C V.T.V.M. (Vacuum Tube Voltmeter)
One Oscilloscope, DuMont #304-A

PROCEDURE:

(1). Adjust variable resistor R-101 to 100 ohms.

(2). Connect the 608-A signal generator to connector J-301 and set the generator for 21.4 mc for Type A IF or 30.0 mc for Type B IF, and 1 mv. output.

(3). Set GAIN control knob fully clockwise.
Set SWEEP control set-screw fully clockwise.
Set HORIZONTAL GAIN control set-screw counter-clockwise.
Set SWEEP WIDTH control knob fully clockwise.
Replace tube V-302.

(4) Adjust coil Z-301, CENTER FREQUENCY CONTROL, and coil L-301 to obtain vertical pips on the cathode-ray tube.

(5). Set CENTER FREQUENCY control knob pointer straight up. Adjust scope controls so that the cathode-ray tube trace is coincident with the calibrated base line, with the ends of the trace as near the end calibration marks as possible.

(6). Adjust coil Z-301 to center of the pip at the "0" mark on the scale.

(7). Adjust coil L-301 for maximum pip movement toward the left side of the screen.

(8). Repeat steps (6) and (7) while reducing the SWEEP WIDTH control, counter-clockwise, until the response covers the entire tube trace.
Reduce GAIN control as necessary.
Repeat the process until no further improvement can be produced.

(9). Remove the cover from the oscillator unit, Figure 8. Connect the VTVM to tiepoint junction of capacitor C-303 and resistor R-301. Connect vertical amplifier of the scope to capacitor C-328.

(10). Reduce SWEEP WIDTH as necessary to prevent a bias voltage from being indicated on the VTVM. Adjust transformer T-301 for maximum response, centered about 25.7 mc with a 3 db bandwidth of approximately 3.6 mc. Marker generator output is to be held near base of the transformer T-301. The correct response wave shows approximately 5% dip.

(11). Repeat steps (8) and (10).

(12). Replace the bottom cover on the oscillator unit. Touch up the adjustments of transformer T-301 for symmetrical response; coil Z-301 for centering of trace with SWEEP reduced; and coil L-301 for maximum movement of pip toward left of trace.

(13). Modulate the 608-A signal generator by the 65-B signal generator. Use 1 mc modulation for Type 200 SDU, and 1.5 mc for Type 300 SDU.

(14). Set SWEEP WIDTH control to maximum.
Set SWEEP control so modulation pip nearest end of trace is approximately ⅛ inch from end of trace.

(15). Adjust HORIZONTAL POSITION (H-POS) control to set center marker at "0". Set HORIZONTAL GAIN (H-GAIN) to position positive (right side) modulation marker under last screen calibration mark on right.

D. FIRST I.F. AMPLIFIER, GENERAL. It is desirable to have an amplitude response that is as nearly constant as possible over the frequency range displayed by the SDU at maximum sweep. The purpose of the first I.F. amplifier is to compensate the amplitude response at the SDU output of a receiver to achieve constancy of amplitude over the frequency range at maximum sweep.

Type "A" IF chassis has a center frequency of 21.4 MC.

Type "B" IF chassis has a center Frequency of 30.0 MC.

Equipment required:

Sweep Generator, RCA WR59C
Signal Generator, Hewlett-Packard 608-A
Oscilloscope, DuMont 304-A, or equivalent Pad, 6 db, 50/50 ohms.
Marker Generator, Measurements Corp, 65-B; or equivalent Receiver (any unit from the Telemetry Rack)
Coaxial Cable, RG-62/U, 4 ft. long with a UG-260/U connector on one end and an amphenol 75-MCIF connector on the other end.
Coaxial Cable, RG-55/U 3 ft. long, with a UG-88/U connector on each end.

(GENERAL INSTRUCTIONS:—The oscilloscope should be connected across capacitor C-223 in type "A" IF chassis, or C-203 in type "B" chassis, and the direct coupled amplifier used. A low capacity shielded cable such as RG-62/U coaxial cable should be used for connection to the oscilloscope. Cable capacity plus oscilloscope input capacity should be held to a maximum of 100 $\mu\mu$f. There is some local oscillator, 25.7 mc, signal present at the signal grid of the mixer due to coupling through the tube. This signal is amplified by tube V-203 and produces a DC output from the detector. However, since there is a base-line for the visual response, no confusion should result. The marker generator signal should be coupled in as required to produce a suitable marker pip. Check that the marker signal does not upset the response shape, by disconnecting and reconnecting the marker generator and observing that the response shape does not change. In general, the marker signal can be introduced through a small capacitor connected to the sweep generator lead.)

PROCEDURE:

(1). Set the SWEEP WIDTH control knob fully counterclockwise.

(2). Set the GAIN control fully clockwise.

(3). Connect the Sweep Generator between pin 1 of tube V-203 and ground on the tube-socket mounting strap nut.

(4). Set the Sweep Generator output to maximum.

(5) a. On units having a type "A", 21.4 MC IF chassis, adjust transformer T-203 for maximum response at the center frequency, then adjust the transformer for equal response at plus or minus 1 mc for Type 200, or 1.5 mc for Type 300 units. The response curve should be round-nosed with a 5% to 10% greater response at center frequency than at plus or minus 1 mc or 1.5 mc on corresponding units.

b. On units having a type "B", 30.0 MC IF chassis, adjust transformer T-202 for maximum response at the center frequency, then adjust the transformer for equal response at plus or minus 1 mc for Type 200, or 1.5 mc for Type 300 units. The response curve should be round-nosed with 5% to 10% greater response at center frequency than at plus and minus 1 mc or 1.5 mc on corresponding units.

(6). Connect the sweep generator between pin 1 of tube V-202 and ground on the tube-socket mounting strap nut. Set generator output to maximum.

(7). Adjust transformers T-202A and T-202B, on type "A", or, T-201A and T-201B on type "B" chassis for a response in which the peaks have equal amplitudes and are symmetrical about the center frequency. This circuit is greatly overcoupled, which will make the response appear to be two separate peaks about 3 mc apart.

(8). Connect the Sweep Generator between the grid pin 1 of tube V-201 and ground on the tube-socket mounting strap nut. Set the output as required to maintain a volt peak deflection.

(9) a. On type "A" units, adjust T-201A and T-201B for maximum amplitude while maintaining equal amplitude outside peaks.

b. On type "B" units, adjust Z-202 for maximum response at center frequency without regard to overall response curve shape.

(10). Connect the SDU to the receiver and connect the Sweep Generator to the receiver input. Set the Sweep Generator output as required to produce a 1 volt peak deflection. Adjust coil L-201 for maximum response *at center frequency* without regard to the overall response shape.

(11) a. On type "A" units, make slight readjustments to T-201A, T-201B, T-202A, and T-202B for flattest overall response while maintaining approximately maximum amplitude.

b. On type "B" units, make slight re-adjustments to T-201A and T-201B for flattest overall response while maintaining approximately maximum amplitude.

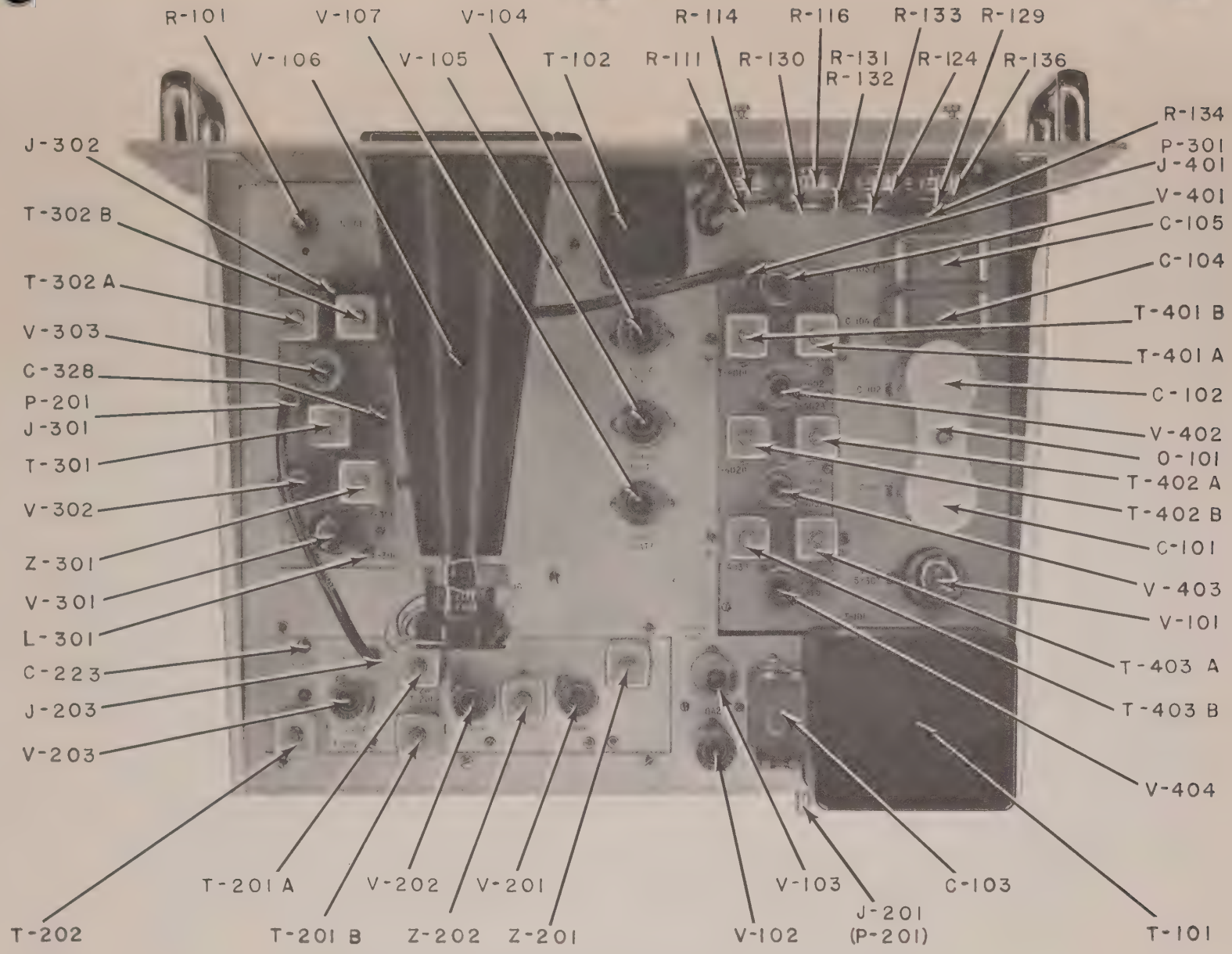



*Figure 4. Top View of Main Chassis, Spectrum Display Unit*

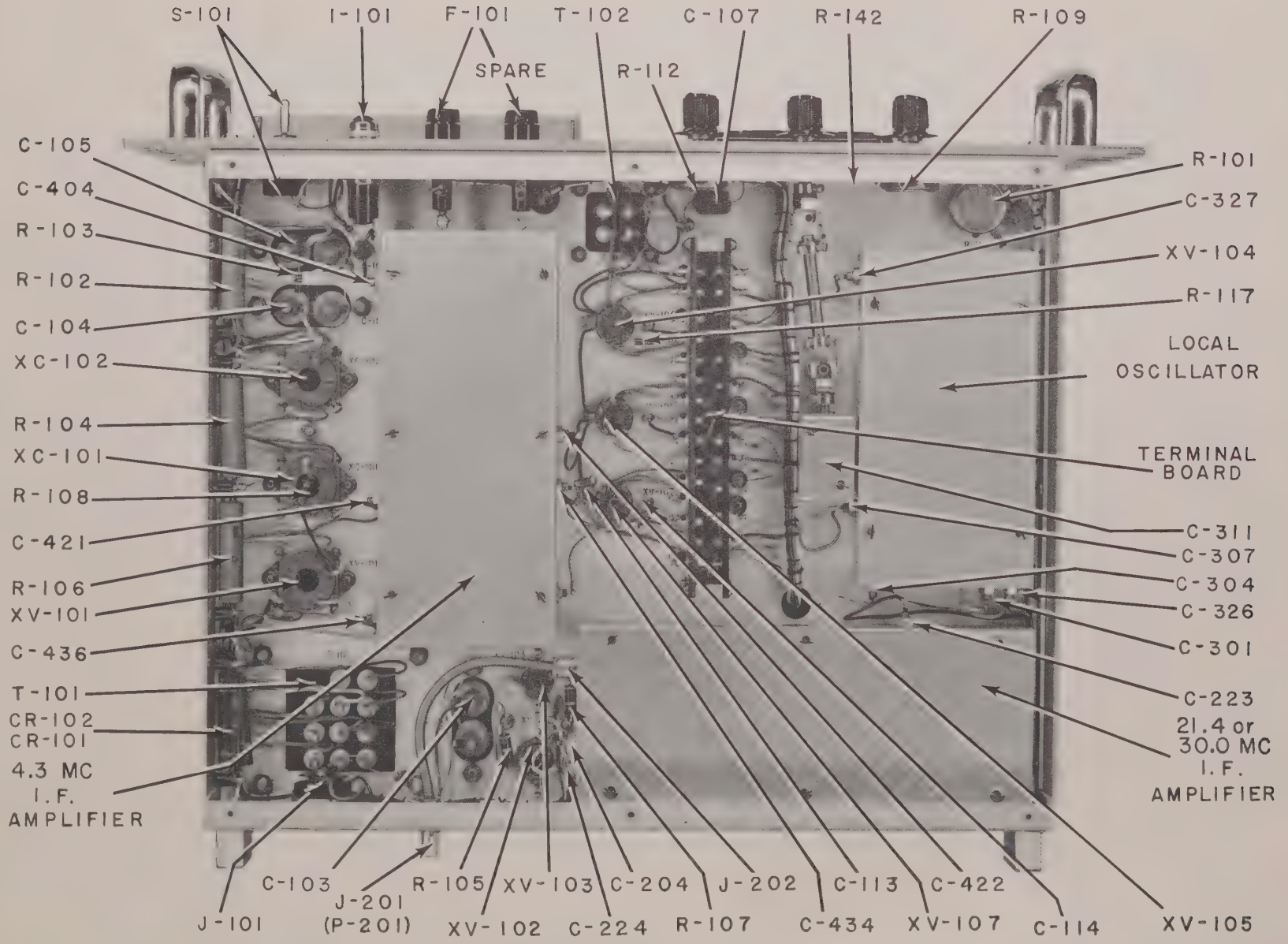



*Figure 5. Bottom View of Main Chassis, Spectrum Display Unit*

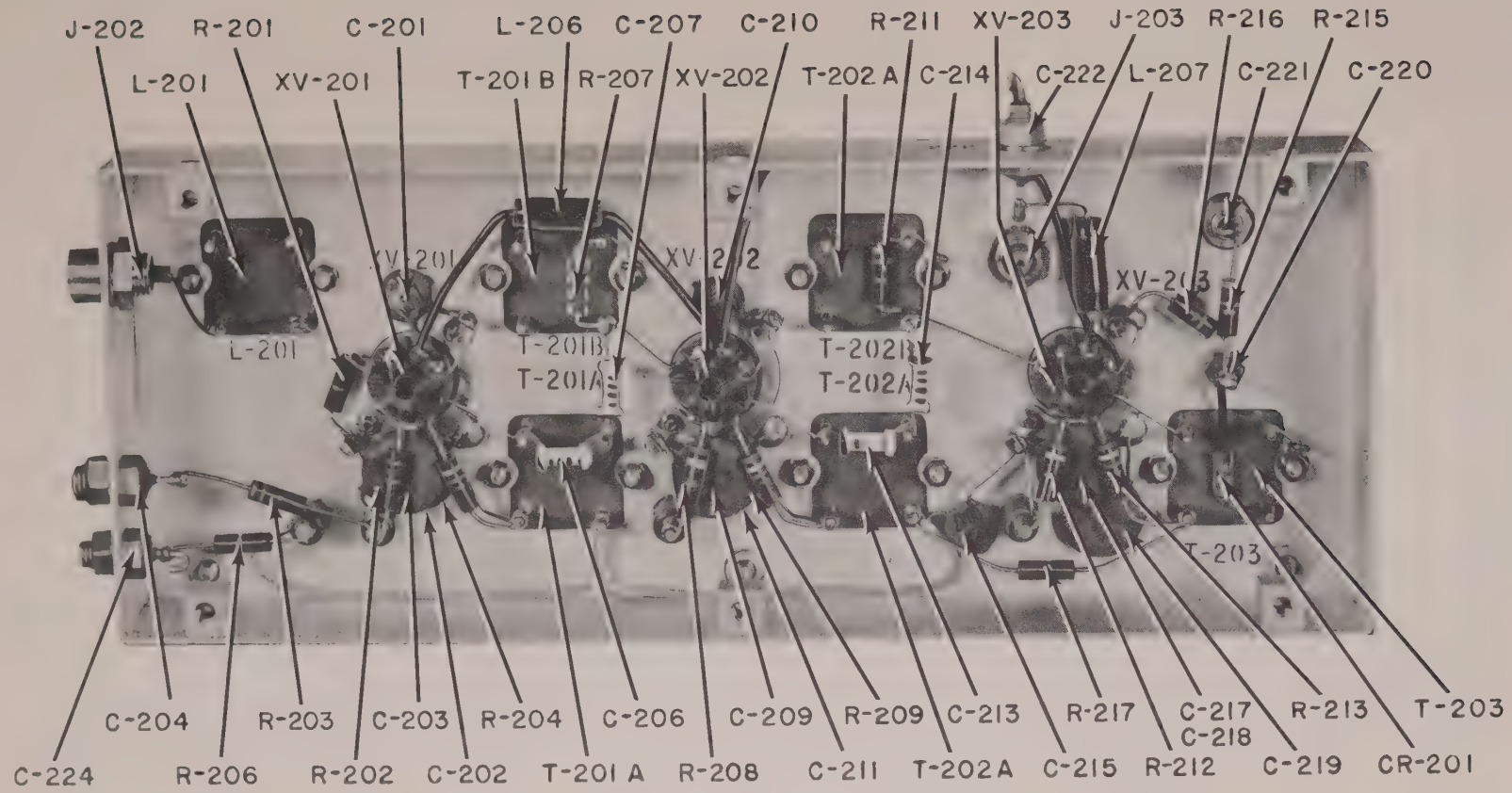



*Figure 6. Type "A" I.F. (21.4 mc) Amplifier Chassis, Spectrum Display Unit*

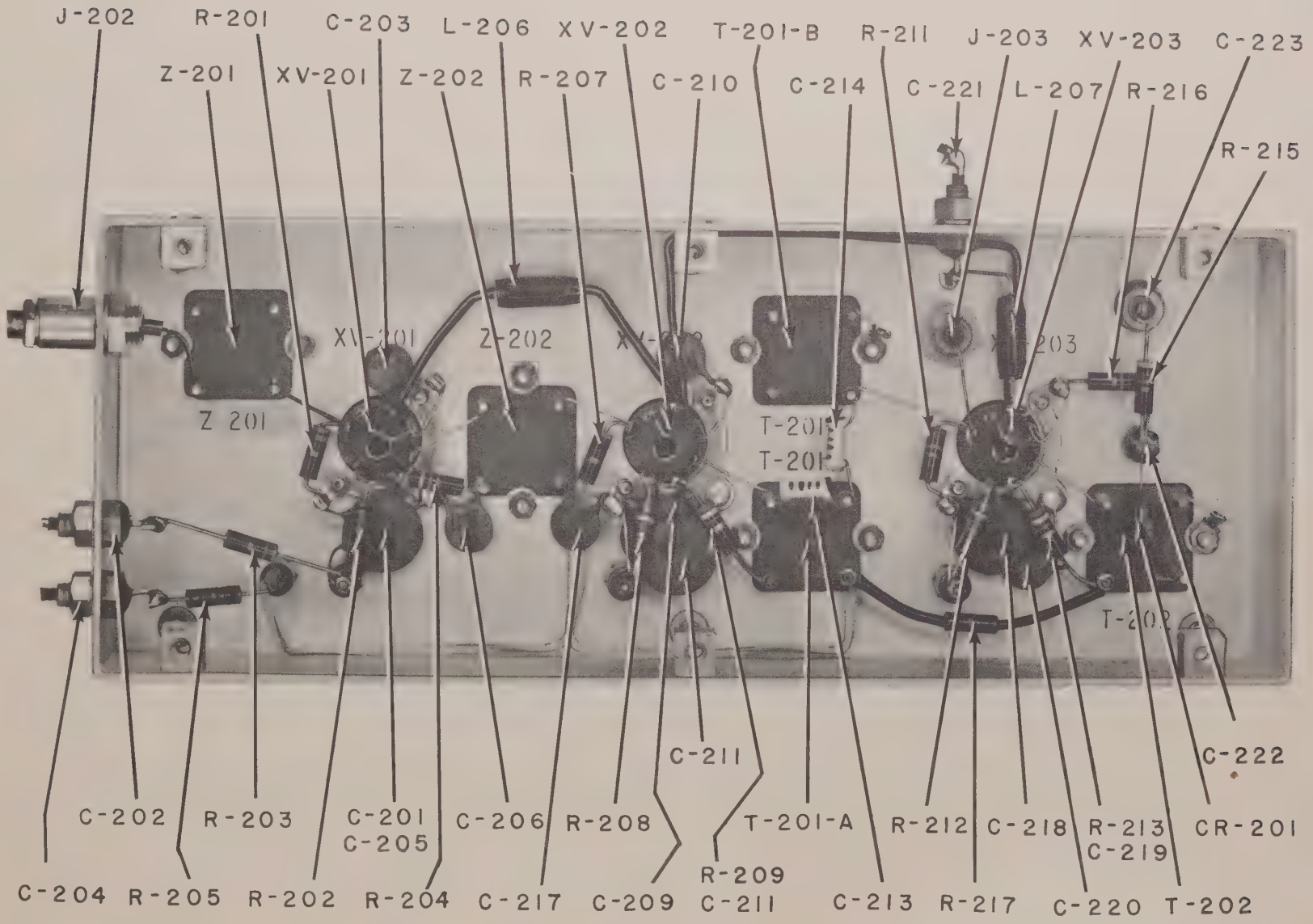



*Figure 7. Type "B" I.F. (30.0 mc) Amplifier Chassis, Spectrum Display Unit*

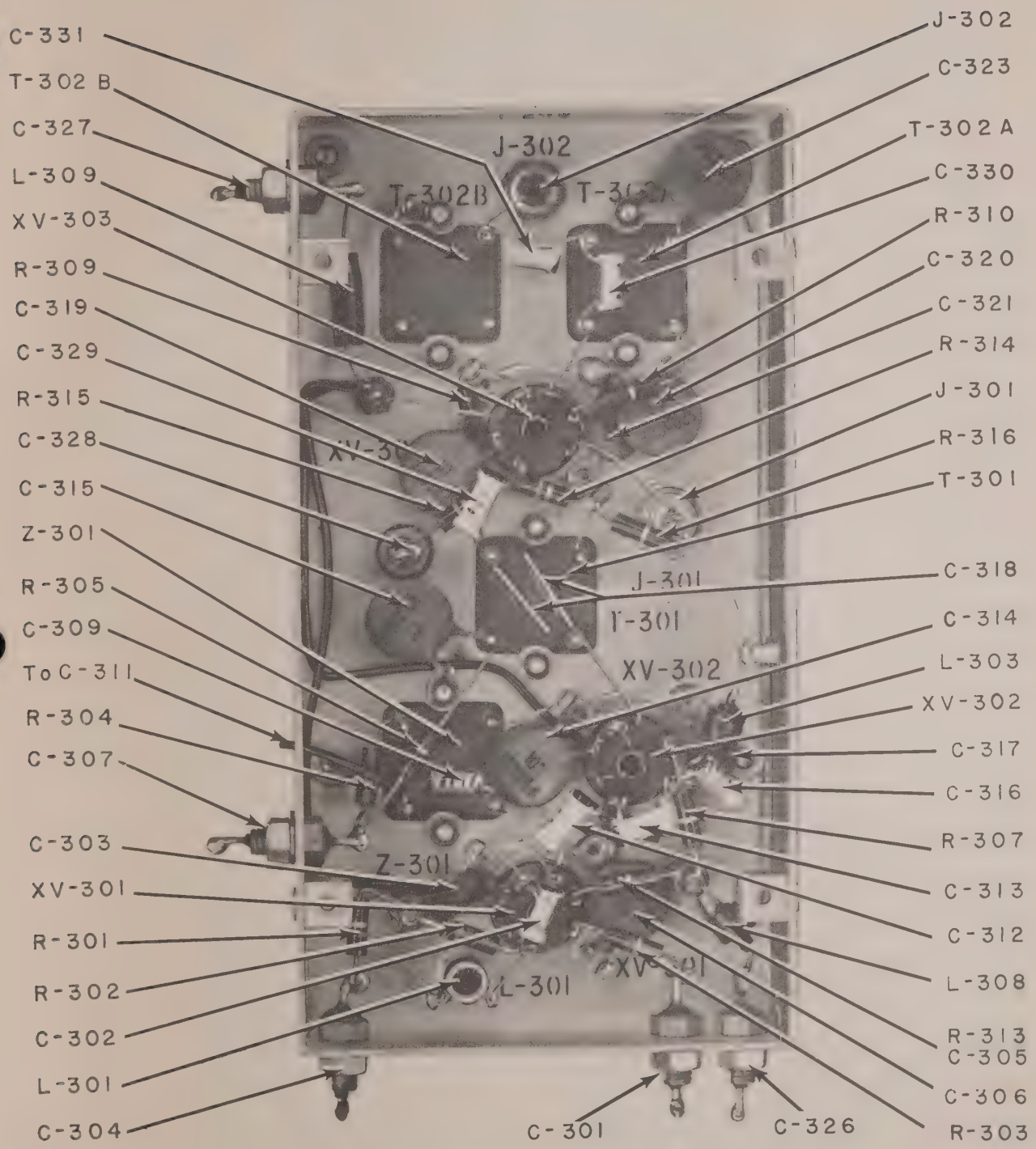



*Figure 8. Local Oscillator Chassis, Spectrum Display Unit*

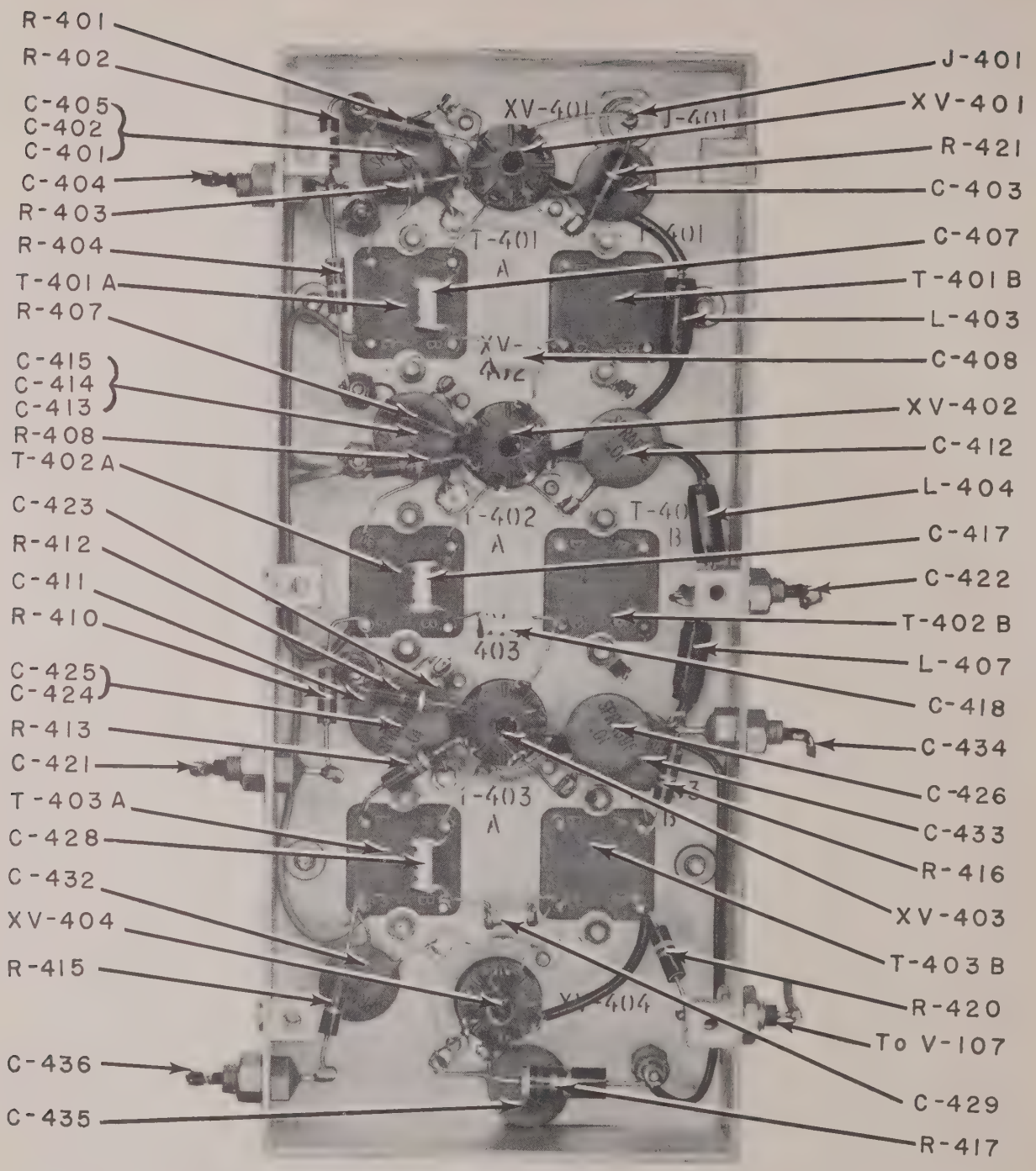



*Figure 9. 4.3 mc I.F. Amplifier, Spectrum Display Unit*

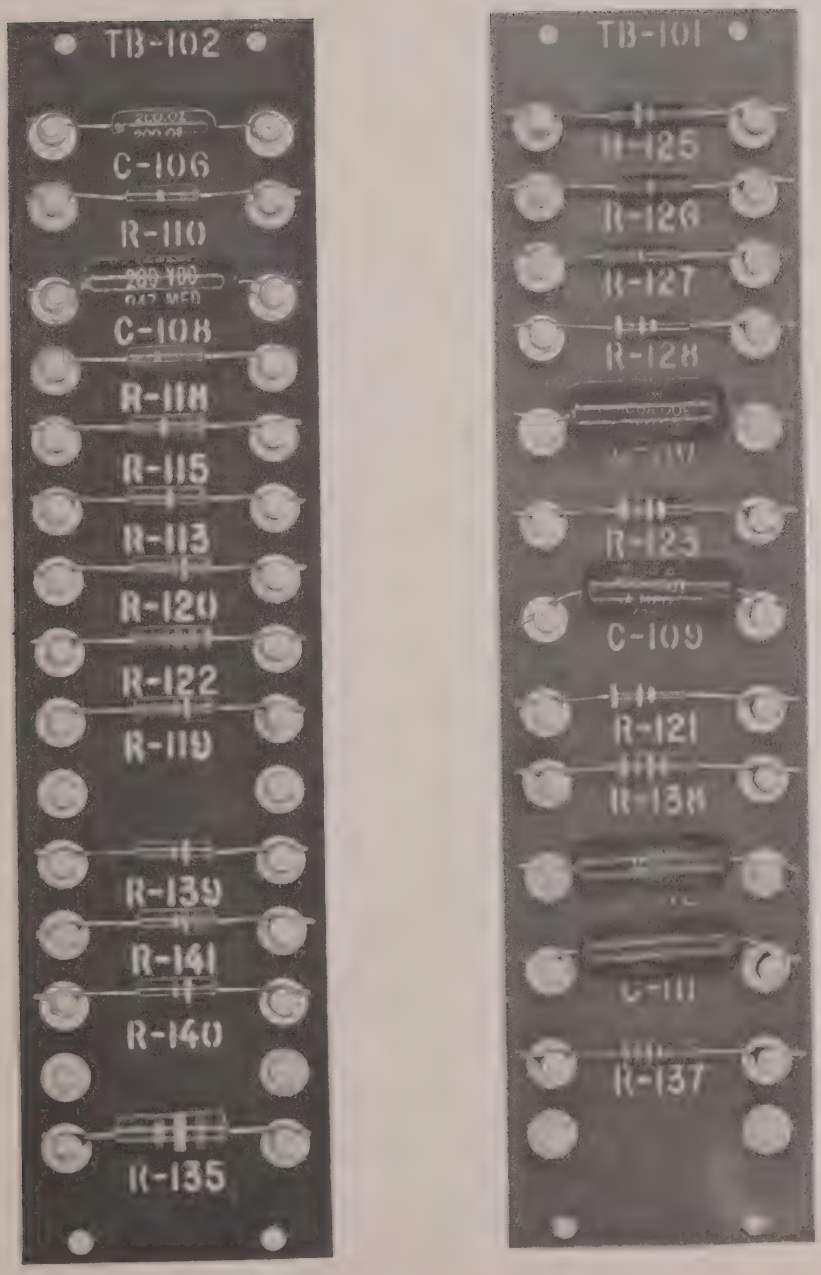



*Figure 10. Terminal Boards, Spectrum Display Units.*

# SECTION 5

## MAINTENANCE PARTS LIST

## SPECTRUM DISPLAY UNITS, ALL MODELS

When ordering replacement parts from NEMS-CLARKE COMPANY which are not available from a local supplier, give the equipment name and type number, the symbol number, and the description of each item ordered.

Replacement parts which will be supplied against an order may not be exact duplicates of the original parts. However, only minor differences in the electrical or mechanical characteristics will be involved, and, consequently will in no way impair the operation of the equipment.

**Note**

Values of items not common to all Spectrum Display Units having a 21.4 MC (Type A) chassis are tabulated in Table 5 following.

The specifications for these items are listed in the parts list in the same manner as other items, except for value, which will be indicated by an asterisk (*) for reference to this table.

TABLE 5. COMPONENT VARIATIONS OF 21.4 MC (TYPE A) FIRST I.F. AMPLIFIERS

| *Spectrum Display Unit* | *C-206* | *C-207* | *C-213* | *C-214* | *R-201* | *R-207* | *R-211* |
|---|---|---|---|---|---|---|---|
| 200-1 | 10 μμf | 15 μμf | 10 μμf | 10 μμf | 4.7 K | 16 K | 2.0 K |
| 200-2 | 10 μμf | 12 μμf | 6.8 μμf | 10 μμf | 2.7 K | Not used | 4.3 K |
| 300-1 | 15 μμf | 22 μμf | 10 μμf | 18 μμf | 3.0 K | 47 K | 2.7 K |
| 300-4 | 15 μμf | 22 μμf | 10 μμf | 18 μμf | 2.7 K | 33 K | 2.4 K |
| Since additional variations occur in the components of the SDU's with 30 MC (Type B) First I.F. Chassis, a separate tabulation for these parts appears in the parts list. | | | | | | | |
| 200-3 & 300-3 | See C-201 thru C-223 and R-201 thru R-217 in the parts list. | | | | | | |

# PARTS LIST

| *Circuit Symbol Number* | *Description and Manufacturer* |
|---|---|
| C-101, (A, B, C) to C-102 (A, B, C) | CAPACITOR, fixed, electrolytic, (dry): 3-section, 20 μfd, ±10% each section; 450-V, DC. Sprague PE-3780. Aerovox AEP444J. |
| C-103 | CAPACITOR, fixed, paper, oil filled: 2 μfd, ±10%, 600V. Sprague (JAN) CP70E1F205K. |
| C-104, 105 | CAPACITOR, fixed, paper, oil filled: 1.0 μfd, ±10%, 1000V, DC. Sprague (JAN) CP70E1G105K. |
| C-106 | CAPACITOR, fixed, paper, metalized: 0.01 μfd, ±10%, 200V. Aerovox P123ZGP. |
| C-107 | CAPACITOR, fixed, paper, metalized: 0.25 μfd, ±10%, 200V. Aerovox P123ZGP. |
| C-108 | CAPACITOR, fixed, paper, metalized: 0.047 μfd, ±10%, 200V. Aerovox P123ZGP. |
| C-109, 110, 111, 112 | CAPACITOR, fixed, paper, metalized: 0.10 μfd, ±10%, 200V. Aerovox P123ZGP. |
| C-113, 114 | CAPACITOR, fixed, ceramic: 470 μμf, ±10%, 500V. Erie GPZ-331. |

| *Type A IF Chassis* | *Type B IF Chassis* | |
|---|---|---|
| C-201, 210, 215, 218, 223, 225, 306, 317, 321, 402, 414, 424 | | CAPACITOR, fixed, ceramic, disc: 4700 μμf, MRC, 500V. Sprague 44C1. |
| | C-201, 209, 211, 218 | CAPACITOR, fixed, ceramic; disc: 0.1 μf, MRC, 500V. Sprague 44C1. |
| C-202, 203, 209, 211, 217, 219, 305, 314, 315, 319, 320, 323, 401, 403, 405, 411, 412, 413, 415, 423, 425, 426, 432, 433, 435. | | CAPACITOR, fixed, ceramic, disc.: 0.01 μfd, MRC, 500V. Sprague 44C1. |
| | C-202, 204, 221. | CAPACITOR, fixed, ceramic, feed-through: 1000 μμf, MRC, 500V. Sprague 514C1. |
| C-203 | | Same as C-202 |
| | C-203, 205, 206, 210, 212, 217, 219, 220. | CAPACITOR, fixed, ceramic, disc: 4700 μμf, MRC, 500V. Sprague 20C8. |

| *Circuit Symbol Number* | | *Description and Manufacturer* |
|---|---|---|
| *Type A IF Chassis* | *Type B IF Chassis* | |
| C-204, 222, 224, 301, 307, 404, 421, 422, 434, 436 | | CAPACITOR, fixed, ceramic, 1000 $\mu\mu$f, MRC, 500V. Sprague 514C1. |
| | C-204 | Same as C-202 |
| C-205 | | CAPACITOR, part of T-201A, not separately replaceable. |
| | C-205, to C-206 | Same as C-203 |
| C-206* | | CAPACITOR, fixed, ceramic: (*), $\pm$5%, 500V. Erie NPO-A. |
| C-207* | | CAPACITOR, fixed, ceramic: (*), $\pm$5%, 500V. Erie NPO-A. |
| | C-207 | CAPACITOR, part of Z-202, not separately replaceable. |
| C-208 | | CAPACITOR, part of T-201B, not separately replaceable. |
| | C-208 | CAPACITOR, part of Z-202, not separately replaceable. |
| C-209 | | Same as C-202 |
| C-210 | C-209 | Same as C-201 |
| | C-210 | Same as C-203 |
| C-211 | | Same as C-202 |
| | C-211 | Same as C-201 |
| C-212 | | CAPACITOR, part of T-202A, not separately replaceable. |
| | C-212 | Same as C-203 |
| C-213* | | CAPACITOR, fixed, ceramic: (*), $\pm$5%, 500V. Erie NPO-A. |
| | C-213, 214 | CAPACITOR, fired, ceramic; 10 $\mu\mu$f, $\pm$10%, 500V. Erie NPO-A. |
| C-214* | | CAPACITOR, fixed, ceramic: (*), $\pm$5%, 500V. Erie NPO-A. |
| | C-214 | Same as C-213 |
| C-215 | | Same as C-201 |
| | C-215 | CAPACITOR, part of T-201A, not separately replaceable. |
| C-216 | | CAPACITOR, part of T-202B, not separately replaceable. |
| | C-216 | CAPACITOR, part of T-201B, not separately replaceable. |
| C-217 | | Same as C-202 |
| | C-217 | Same as C-203 |
| C-218 | C-218 | Same as C-201 |

*Refer to Table 5 for values applying to each type of SDU.

| *Circuit Symbol Number* | *Description and Manufacturer* | |
|---|---|---|
| *Type A IF Chassis* | *Type B IF Chassis* | |
| C-219 | | Same as C-202 |
| | C-219 | Same as C-203 |
| C-220 | | CAPACITOR, fixed, ceramic, standoff: 470 μμf, MRC, 500V. Sprague 507C8A. |
| | C-220 | Same as C-203 |
| C-221, 304, 328 | | CAPACITOR, fixed, ceramic, feedthru: 47 μμf, ±20%, 500V. Sprague 514C11A. |
| | C-221 | Same as C-202 |
| C-222 | | Same as C-204 |
| | C-222 | CAPACITOR, fixed, ceramic, 470 μμf, MRC, 500V. Sprague 507-C8A. |
| C-223 | | Same as C-201 |
| | C-223 | CAPACITOR, fixed, ceramic, feedthru: 47 μμf, ±20%, 500V. Sprague 514C11A. |
| C-224 | Not used. | Same as C-204 |
| C-225 | Not used. | Same as C-201 |
| C-301 | Same as C-204 | |
| C-302 | CAPACITOR, fixed, ceramic: 3.9 μμf, ±0.25 μμf, 500V. Erie NOP-A. | |
| C-303, 326, 327 | CAPACITOR, fixed, ceramic: 1000 μμf, ±10%, 500V. Erie GP2-331. | |
| C-304 | Same as C-221 | |
| C-305 | Same as C-202 | |
| C-306 | Same as C-201 | |
| C-307 | Same as C-204 | |
| C-308 | CAPACITOR, part of Z-301, not separately replaceable. | |
| C-309 | CAPACITOR, fixed, ceramic: 15 μμf, ±5%, 500V. Erie NPO-A. | |
| C-310 | Not used | |
| C-311 | CAPACITOR, variable, air dielectric: 1.5-5 μμf, 750V, 60C, AC. Hammarlund MAC-5. | |
| C-312, 313, 316, 329 | CAPACITOR, fixed, ceramic: 33 μμf, ±5%, 500V. Erie NPO-T. | |

| *Circuit Symbol Number* | *Description and Manufacturer* |
|---|---|
| C-313 | Same as C-312 |
| C-314 to C-315 | Same as C-202 |
| C-316 | Same as C-312 |
| C-317 | Same as C-201 |
| C-318 | CAPACITOR, variable, air dielectric: Bus wires between pins A and C of T-301, not separately replaceable. |
| C-319 to C-320 | Same as C-202 |
| C-321 | Same as C-201 |
| C-322 | CAPACITOR, part of T-302A, not separately replaceable. |
| C-323 | Same as C-202 |
| C-324 to C-325 | CAPACITOR, part of T-302B, not separately replaceable. |
| C-326 to C-327 | Same as C-303 |
| C-328 | Same as C-221 |
| C-329 | Same as C-312 |
| C-330, 331, 407, 408, 417, 418, 428 | CAPACITOR, fixed, ceramic: 1.5 $\mu\mu$f, $\pm$0.1 $\mu\mu$f, 500V. Erie NPO-A. |
| C-331 | Same as C-330 |
| C-401 | Same as C-202 |
| C-402 | Same as C-201 |
| C-403 | Same as C-202 |
| C-404 | Same as C-204 |
| C-405 | Same as C-202 |
| C-406 | CAPACITOR, part of T-401A, not separately replaceable. |
| C-407 to C-408 | Same as C-330 |

| *Circuit Symbol Number* | *Description and Manufacturer* |
|---|---|
| C-409 to C-410 | CAPACITOR, part of T-401B, not separately replaceable. |
| C-411 to C-413 | Same as C-202 |
| C-414 | Same as C-201 |
| C-415 | Same as C-202 |
| C-416 | CAPACITOR, part of T-402A, not separately replaceable. |
| C-417 to C-418 | Same as C-330 |
| C-419 to C-420 | CAPACITOR, part of T-402B, not separately replaceable. |
| C-421 to C-422 | Same as C-204 |
| C-423 | Same as C-202 |
| C-424 | Same as C-201 |
| C-425 to C-426 | Same as C-202 |
| C-427 | CAPACITOR, part of T-403A, not separately replaceable. |
| C-428 | Same as C-330 |
| C-429 | CAPACITOR, fixed, ceramic: 1.2 $\mu\mu$f, $\pm$0.1 $\mu\mu$f, 500V. Erie NPO-A. |
| C-430 to C-431 | CAPACITOR, part of T-403B, not separately replaceable. |
| C-432 to C-433 | Same as C-202 |
| C-434 | Same as C-204 |
| C-435 | Same as C-202 |
| C-436 | Same as C-204 |

| *Circuit Symbol Number* | *Description and Manufacturer* |
|---|---|
| CR-101, 102 | RECTIFIER, selenium: half-wave circuit, single phase; half-wave rectification; 780V AC, RMS. max. input: 315V, DC; 5 ma max. output. Sarkes-Tarzian A-302; Type 026-30H-QC. |
| CR-102 | Same as CR-101 |
| CR-201 | DIODE, CRYSTAL, germanium: 60V continuous reverse working voltage; 5-ma at +1 volt forward current; 100 K reverse resistance at 50V. Raytheon CK-705/IN66. |
| E-101, 102, 103 | KNOB, black bakelite: round, with pointer; set-screw type, for ¼″ shaft. Molded Insulation VIZ-A. |
| E-104 to E-105 | KNOB, black bakelite: round, for ¼″ shaft. Waldon 1450. |
| F-101 to F-102 | FUSE, slo-blo: 1-amp, 250V. Type 3AG. Littlefuse 313-001. |
| I-101 | LAMP, incandescent: 6-8 V. 0.15 amp; bayonet base, T-3¼ bulb, clear. G.-E #47. |
| J-101 | CONNECTOR, receptacle: 15 amp at 125V, AC. Hubbel 7486. |
| J-201 | CONNECTOR, receptacle, RF: type UG-291/U. |
| J-202 | CONNECTOR, coaxial terminal, RF: type MX-1684/U. IPC 1025. |
| J-203, 302 | CONNECTOR, coaxial terminal, RF: Type MX-1530/U. IPC 1050. |
| J-301 | CONNECTOR, receptacle, RF: Type UG-1094/U. |
| J-302 | Same as J-203. |
| J-401 | Same as J-301. |
| L-201 | (Type A, IF) COIL, RF, variable: NEMS-CLARKE dwg/no. AB-17,612<br>(Type B, IF) COIL, RF: part of Z-201, not separately replaceable. |
| L-202 | (Type A) COIL: part of T-201A, not separately replaceable.<br>(Type B) COIL: part of Z-202, not separately replaceable. |
| L-203 | (Type A) COIL: part of T-201B, not separately replaceable.<br>(Type B) COIL: part of T-201A, not separately replaceable. |
| L-204 | (Type A) COIL: part of T-202A, not separately replaceable.<br>(Type B) COIL: part of T-201B, not separately replaceable. |
| L-205 | (Type A) COIL: part of T-202B, not separately replaceable. |
| L-205A, B | (Type B) COIL: part of T-202, not separately replaceable. |
| L-206, 207, 309, 403, 404, 407 | CHOKE, RF: 2.8 μh. NEMS-CLARKE part/dwg no. A-16,225. |
| L-207 | Same as L-206 |
| L-301 | COIL, RF; 6.5-10.6 μh, 1.25 ohms DC resistance; 29 turns Litz wire #6/44; single wound; with tuning capacitor. Cambridge Thermionic Corp. X-2060-3. |

| *Circuit Symbol Number* | *Description and Manufacturer* |
|---|---|
| L-302 | COIL: part of Z-301, not separately replaceable. |
| L-303 | CHOKE, RF: 75 μh, 3.8 ohms DC resistance. Wilco 1075-15. |
| L-304 to L-305 | COIL: part of T-301, not separately replaceable. |
| L-306 | COIL: part of T-302A, not separately replaceable. |
| L-307 | COIL: part of T-302B, not separately replaceable. |
| L-308 | CHOKE, RF: 240 μh, 502 ohms DC resistance. Wilco 3240-15. |
| L-309 | Same as L-206 |
| L-401 | COIL: part of T-401A, not separately replaceable. |
| L-402 | COIL: part of T-401B, not separately replaceable. |
| L-403 to L-404 | Same as L-206 |
| L-405 | COIL: part of T-402A, not separately replaceable. |
| L-406 | COIL: part of T-402B, not separately replaceable. |
| L-407 | Same as L-206 |
| L-408 | COIL: part of T-403A, not separately replaceable. |
| L-409 | COIL: part of T-403B, not separately replaceable. |
| O-101 | CLAMP, capacitor: NEMS-CLARKE part/dwg no. A-15,686. |
| O-102 to O-103 | SHIELD, electron tube: (for 7-pin, min., T-5½ envelope) Type TS-102U03. Elco Corp. 149. |
| O-104 to O-105, 107 | SHIELD, electron tube: (for 9-pin, min., RETMA envelope style 6½); type TS-103U02. Elco Corp. 191. |
| O-106 | SHIELD, cathode-ray tube: (for 3RP1-A C.R.T.); type S-3001. Jan Hardware. |
| O-107 | Same as O-104 |
| O-201 to O-203, 401, 402, 403 | SHIELD, electron tube: (for 7-pin min., T-5½ envelope) type TS102U02. |
| O-301 to O-303 | SHIELD, electron tube: (for 7-pin, min., T-5½ envelope) Collins 66J-2. |

| *Circuit Symbol Number* | *Description and Manufacturer* |
|---|---|
| O-401 to O-403 | Same as O-201 |
| O-404 | SHIELD, electron tube: (for 7-pin, min., T-5½ envelope) (JAN) TS102U01. Elco 12. |
| P-201, P-301 | CONNECTOR, plug, RF: Progress Electronics UG-260/U. |
| P-301 | Same as P-201. |
| R-101 | RESISTOR, variable, composition: 500 ohms, ±10%, 2 W. Ohmite CLU-5011-SD4040L. |
| R-102, 104, 106 | RESISTOR, fixed, wirewound, inductive winding: 5 K, ±5%, 10 W. Sprague NIT. |
| R-103 | RESISTOR, fixed, composition: 47 K, ±10%, ½ W. Allen-Bradley EB-4731. |
| R-104 | Same as R-102 |
| R-105, 107 | RESISTOR, fixed, composition: 470 ohms, ±10%, 1 W. Allen-Bradley GB-4711. |
| R-106 | Same as R-102 |
| R-107 | Same as R-105 |
| R-108, 142, 301, 416 | RESISTOR, fixed, composition: 10 K, ±10%, ½ W. Allen-Bradley EB-1031. |
| R-109 | RESISTOR, fixed, composition: 10 K, ±10%, 2 W. Allen Bradley JB-1031, F3040. |
| R-110 | RESISTOR, fixed, composition: 1.8 Meg, ±10%, ½ W. (JAN) RC20GF185K. |
| R-111 | RESISTOR, variable, composition: 1 meg, ±20%, 2 W. Allen-Bradley JLU-1052, SD4040L. |
| R-112, 129 | RESISTOR, variable, composition: 500 K, ±10%, 2 W. Allen-Bradley JLU-5041, P3040. |
| R-113 | RESISTOR, fixed, composition: 1.5 K, ±5%, ½ W. Allen-Bradley EB-1521. |
| R-114, 116 | RESISTOR, variable, composition: 10 K, ±10%, 2 W. Allen-Bradley JLU-1031. |
| R-115, 310 | RESISTOR, fixed, composition: 6.8 K, ±10%, ½ W. Allen-Bradley EB-6821. |
| R-116 | Same as R-114 |
| R-117, 206, 303, 401, 407 | RESISTOR, fixed, composition: 100 ohm, ±10%, ½ W. Allen-Bradley EB-1011. |
| R-118 | RESISTOR, fixed, composition: 2 meg, ±5%, ½ W. Allen-Bradley EB-2055. |

| *Circuit Symbol Number* | *Description and Manufacturer* |
|---|---|
| R-119 to R-120 | RESISTOR, fixed, composition: 150 K, ±5%, ½ W. Allen-Bradley EB-1545. |
| R-121, 123, 138, 312, 406, 411 | RESISTOR, fixed, composition: 470 K, ±10%, ½ W. Allen-Bradley EB-4741. |
| R-122 | RESISTOR, fixed, composition: 33 K, ±5%, ½ W. Allen-Bradley EB-3335. |
| R-123 | Same as R-121 |
| R-124 | RESISTOR, variable, composition: 25 K, ±10%, 2 W. Allen-Bradley JLU-2531. |
| R-125, 139, 140 | RESISTOR, fixed, composition: 100 K, ±5%, ½ W. Allen-Bradley EB-1025. |
| R-126 to R-127 | RESISTOR, fixed, composition: 8.2 K, ±5%, ½ W. Allen-Bradley EB-8225. |
| R-128, 215, 216 | RESISTOR, fixed, composition: 47 K, ±5%, ½ W. Allen-Bradley EB-4735. |
| R-129 | Same as R-112 |
| R-130 | RESISTOR, variable, composition: 50 K, ±10%, 2 W. Allen-Bradley JU-5031. |
| R-131 | RESISTOR, fixed, composition: 120 K, ±10%, ½ W. Allen Bradley EB-1241. |
| R-132 | RESISTOR, fixed, composition: 56 K, ±10%, ½ W. Allen-Bradley EB-5631. |
| R-133 | RESISTOR, variable, composition: 250 K, ±10%, 2 W. Allen-Bradley JU-2541, P-3040. |
| R-134 | RESISTOR, fixed, composition: 330 K, ±10%, 1 W. Allen-Bradley GB-3341. |
| R-135 | RESISTOR, fixed, composition: 160 K, ±5%, 1 W. Allen-Bradley GB-1645. |
| R-136 | RESISTOR, variable, composition: 5 K, ±10%, 2 W. Allen-Bradley JLU-5021, SD-4040L. |
| R-137 | RESISTOR, fixed, composition: 36 K, ±5%, ½ W. Allen-Bradley EB-3635. |
| R-138 | Same as R-121. |
| R-139 to R-140 | Same as R-125 |
| R-141 | RESISTOR, fixed, composition: 27 K, ±5%, ½ W. Allen-Bradley EB-2735. |
| R-142 | Same as R-108 |

| *Circuit Symbol Number* | | *Description and Manufacturer* |
|---|---|---|
| *Type A IF Chassis* | *Type B IF Chassis* | |
| R-201* | | RESISTOR, fixed, composition: (*), ±5%, ½ W. (JAN) RC20GF (*)J. |
| | R-201 | RESISTOR, fixed, composition: 3.3 K, ±5%, ½ W. (JAN) RC20GF335J; Allen-Bradley EB-3325. |
| R-202 | R-202 | RESISTOR, fixed, composition: 130 ohms, ±5%, ½ W. (JAN) RC20GF131J; Allen-Bradley EB-1315. |
| R-203 | R-203 | RESISTOR, fixed, composition: 33 ohms, ±5%, ½ W. (JAN) RC20GF330J; Allen-Bradley EB-3305. |
| R-204, 306, 403, 408 | R-204, 306 | RESISTOR, fixed, composition: 24 K, ±5%, ½ W. (JAN) RC20GF243J; Allen-Bradley EB-2435. |
| R-205 | | RESISTOR, part of T-201A, not separately replaceable. |
| | R-205 | RESISTOR, fixed, composition: 100 ohms, ±5%, ½ W. (JAN) RC20GF101K; Allen-Bradley EB-1015. |
| R-206 | | Same as R-117 |
| | R-206 | RESISTOR, part of Z-202, not separately replaceable. |
| R-207* | | RESISTOR, fixed, composition: (*), ±5%, ½ W. (JAN) RC20GF(*)J. |
| | R-207 | RESISTOR, fixed, composition: 3 K, ±5%, ½ W. (JAN) RC20GF302J; Allen-Bradley EB-3025. |
| R-208, 212, 412 | R-208, 212, 412 | RESISTOR, fixed, composition: 390 ohms, ±5%, ½ W. (JAN) RC20GF391J; Allen-Bradley EB-3915. |
| R-209, 213, 413 | R-209, 213, 413 | RESISTOR, fixed, composition: 39 K, ±5%, ½ W. (JAN) RC20GF393J; Allen-Bradley EB-3935. |
| R-210 | | RESISTOR, part of T-202A, not separately replaceable. |
| | T-210 | RESISTOR, part of T-201A, not separately replaceable. |
| R-211* | | RESISTOR, fixed, composition: (*), ±5%, ½ W. (JAN) RC20GF(*)J. |
| | R-211 | RESISTOR, fixed, composition: 15 K, ±5%, ½ W. (JAN) RC20GF153J. Allen-Bradley EB-1535. |
| R-212 | R-212 | Same as R-208 |
| R-213 | R-213 | Same as R-209 |
| R-214 | | RESISTOR, part of T-203, not separately replaceable. |
| | R-214 | RESISTOR, part of T-202, not separately replaceable. |



*Refer to Table 5 for values applying to each type of SDU.

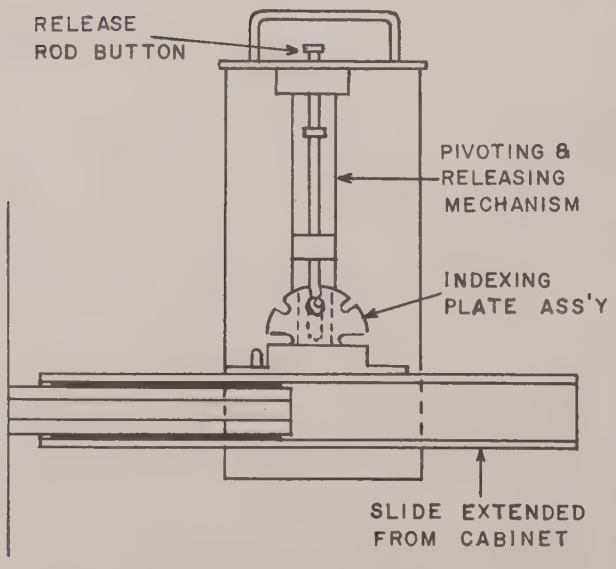
| *Circuit Symbol Number* | *Description and Manufacturer* | |
|---|---|---|
| *Type A IF Chassis* | *Type B IF Chassis* | |
| R-215 to R-216 | R-215 to R-216 | Same as R-128 |
| R-217, 304, 305, 307 | R-217, 304, 305, 307 | RESISTOR, fixed composition: 1 K, 10%, ½ W. (JAN) RC20GF102K; Allen-Bradley EB-1021. |
| R-301 | Same as R-108 | |
| R-302 | RESISTOR, fixed, composition: 330 ohms, ±5%, ½ W. (JAN) RC20GF331J; Allen-Bradley EB-3315. | |
| R-303 | Same as R-117 | |
| R-304 to R-305 | Same as R-217 | |
| R-306 | Same as R-204 | |
| R-307 | Same as R-217 | |
| R-308 | RESISTOR, part of T-301, not separately replaceable. | |
| R-309 | RESISTOR, fixed, composition: 150 ohms, ±10%, ½ W. (JAN) RC20GF151K; Allen-Bradley EB-1511. | |
| R-310 | Same as R-115. | |
| R-311 | RESISTOR, part of T-302A, not separately replaceable. | |
| R-312 | RESISTOR, part of T-302B, not separately replaceable. | |
| R-313, 410, 415 | RESISTOR, fixed, composition: 270 ohms, ±10%, ½ W. (JAN) RC20GF271K; Allen-Bradley EB-2711. | |
| R-314 to R-315 | RESISTOR, fixed, composition: 100K, ±10%, ½ W. (JAN) RC20GF104K. Allen-Bradley EB-1045. | |
| R-316, 421 | RESISTOR, fixed, composition: 1 meg, ±5%, ½ W. (JAN) RC20GF105J. Allen-Bradley EB-1055. | |
| R-401 | Same as R-117 | |
| R-402, 404 | RESISTOR, fixed, composition: 33 ohms, ±10%, ½ W. (JAN) RC20GF330K, Allen-Bradley EB-3301. | |
| R-403 | Same as R-204 | |
| R-404 | Same as R-402 | |
| R-405 | RESISTOR, part of T-401A, not separately replaceable. | |

| *Circuit Symbol Number* | *Description and Manufacturer* |
|---|---|
| R-406 | RESISTOR, part of T-401B, not separately replaceable. |
| R-407 | Same as R-117 |
| R-408 | Same as R-204 |
| R-409 | RESISTOR, part of T-402A, not separately replaceable. |
| R-410 | Same as R-313 |
| R-411 | RESISTOR, part of T-402B, not separately replaceable. |
| R-412 | Same as R-208 |
| R-413 | Same as R-209 |
| R-414 | RESISTOR, part of T-403A, not separately replaceable. |
| R-415 | Same as R-313 |
| R-416 | Same as R-108 |
| R-417 | RESISTOR, fixed, composition: 4.7 ohms, ±10%, 1 W. (JAN) RC20GF4R7K; Allen-Bradley EB-4R71. |
| R-418 to R-419 | RESISTOR, part of T-403B, not separately replaceable. |
| R-420 | RESISTOR, fixed, composition: 220 K, ±10%, ½ W. (JAN) RC20GF224K; Allen-Bradley EB-2241. |
| R-421 | Same as R-316 |
| T-101 | TRANSFORMER, power: NEMS-CLARKE part/dwg no. AC-17,745. |
| T-102 | TRANSFORMER, output: NEMS-CLARKE part/dwg. no. AB-17,744. |
| T-201A | (Type A, IF Chassis) TRANSFORMER, IF: NEMS-CLARKE dwg/no. AB-17,614.<br>(Type B, IF Chassis) TRANSFORMER, IF: NEMS-CLARKE dwg/no. AB-17,989. |
| T-201B | (Type A, IF Chassis) TRANSFORMER, IF: NEMS-CLARKE dwg/no. AB-17,613.<br>(Type B, IF Chassis) TRANSFORMER, IF: NEMS-CLARKE dwg/no. AB-17,987. |
| T-202 | (Type B, IF Chassis) TRANSFORMER, IF: NEMS-CLARKE dwg/no. AB-17,985. |
| T-202A | (Type A, IF Chassis) Same as T-201A. |
| T-202B | (Type A, IF Chassis) TRANSFORMER, IF: NEMS-CLARKE dwg/no. AB-17,615. |
| T-203 | (Type A, IF Chassis) TRANSFORMER, IF: NEMS-CLARKE dwg/no. AB-17,611. |
| T-301 | TRANSFORMER, IF: NEMS-CLARKE part/dwg no. AB-17,910. |
| T-302A, 401A, 402A, 403A | TRANSFORMER, IF: NEMS-CLARKE part/dwg no. AB-17,553. |

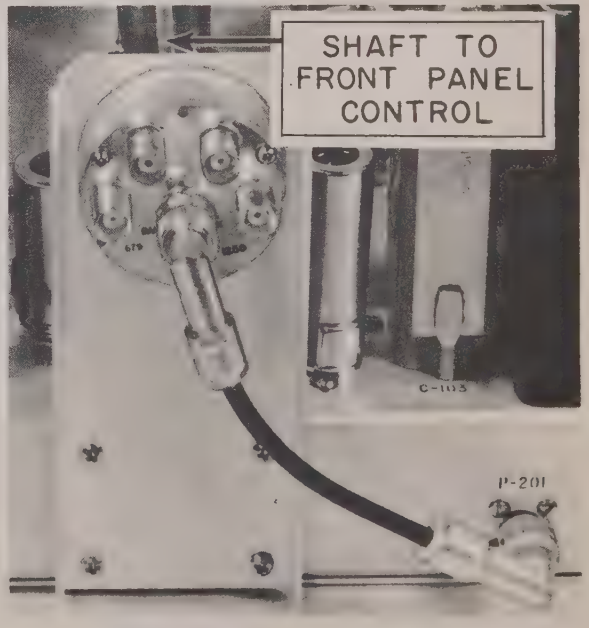
| *Circuit Symbol Number* | *Description and Manufacturer* |
|---|---|
| T-302B, 401B, 402B | TRANSFORMER, IF: NEMS-CLARKE part/dwg no. AB-17,625. |
| T-401A | Same as T-302A |
| T-401B | Same as T-302B |
| T-402A | Same as T-302A |
| T-402B | Same as T-302B |
| T-403A | Same as T-302A |
| T-403B | TRANSFORMER, IF: NEMS-CLARKE part/dwg no. AB-17,624. |
| V-101 | TUBE, electron: 5Y3GT. |
| V-102 | TUBE, electron: OA2. |
| V-103 | Same as V-102 |
| V-104 | TUBE, electron: 12AU7A. |
| V-105 | TUBE, electron: 12AT7. |
| V-106 | TUBE, electron: 3RP1-A. |
| V-107 | Same as V-105 |
| V-201 | TUBE, electron: 6BA6. |
| V-202 | TUBE, electron: 6BU6. |
| V-203 | Same as V-202 |
| V-301 | TUBE, electron: 6AH6 |
| V-302 | Same as V-202 |
| V-303 | TUBE, electron: 6BE6. |
| V-401 to V-402 | Same as V-201 |
| V-403 | Same as V-202 |
| V-404 | TUBE, electron: 6AL5. |

| *Circuit Symbol Number* | *Description and Manufacturer* |
|---|---|
| W-101 | CABLE, connecting, power: NEMS-CLARKE part/dwg. no. AA-19,709. |
| XF-101 to XF-102 | FUSEHOLDER, bakelite: (for 3AG fuse) Bussman HKP |
| XI-101 | LAMPHOLDER, min. bayonet base: green lens. Dialco 81410-112 |
| XC-101<br>XC-102<br>XV-101 | SOCKET, electron tube: octal. (JAN) TS101P01. |
| XV-102 to XV-103 | SOCKET, electron tube: 7 pin, min. Elco BR-151-BC. |
| XV-104 to XV-105 | SOCKET, electron tube: 9 pin, min. Elco BR-283-BC. |
| XV-201 to XV-203 | Same as XV-102 |
| XV-301 to XV-303 | Same as XV-102 |
| XV-401 to XV-404 | Same as XV-102 |
| Z-201 | (Type B, IF Chassis) FILTER, IF: input. NEMS-CLARKE part/dwg no. AB-17,988. |
| Z-202 | (Type B, IF Chassis) FILTER, IF: interstage. NEMS-CLARKE part/dwg no. AB-17,986. |
| Z-301 | FILTER, IF: interstage. NEMS-CLARKE part/dwg. no. AB-17,909. |

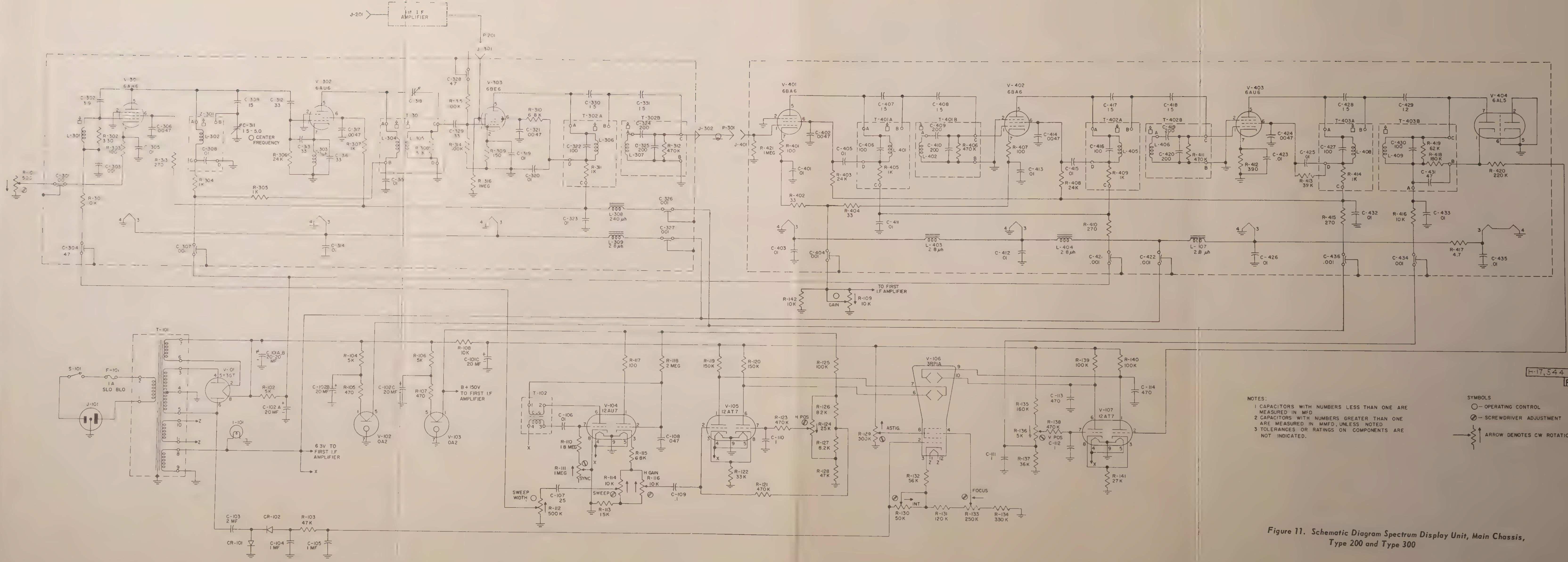
## *ACCESSORIES FOR SPECTRUM DISPLAY UNITS AVAILABLE FROM NEMS-CLARKE COMPANY*




*SMT Slide Mounting Assembly*




*SWK-100 Switch Kit Assembly*


J-201
1st I F AMPLIFIER
P 201
J 301
V-301 6AH6
C-302 3.9
L-301
R-302 330
R-303 100
C-303 .001
C-305 .01
C-306 .0047
R-101 500
C-301 .00
R-301 10K
C-304 47
R-313 270
Z-301
C-309 15
C-311 1.5-5.0
CENTER FREQUENCY
L-302
C-308 .01
R-304 1K
R-305 1K
C-307 .001
C-312 33
V-302 6AU6
C-313 33
L-303
C-316 33
R-306 24K
C-317 .0047
R-307 1K
C-314 .01
C-318
T-301
L-304
L-305
R-308 5.6K
C-315 .01
C-328 47
R-315 100K
R-314 100K
R-316 1MEG
C-329 33
V-303 6BE6
R-309 150
C-319 .01
R-310 6.8K
C-321 .0047
C-320 .01
C-330 1.5
C-331 1.5
T-302A
T-302B
C-322 100
L-306
R-311 1K
C-324 200
C-325 200
L-307
R-312 470K
C-323 .01
L-308 240 µh
L-309 2.8 µh
C-326 .001
C-327 .001
J-302
P-301
J-401
R-421 1MEG
V-401 6BA6
R-401 100
C-401 .01
C-402 .0047
R-402 33
R-403 24K
R-404 33
C-403 .01
C-404 .001
C-405 .01
T-401A
T-401B
C-406 100
C-407 1.5
C-408 1.5
C-409 200
C-410 200
L-401
L-402
R-405 1K
R-406 470K
C-411 .01
L-403 2.8 µh
V-402 6BA6
R-407 100
C-413 .01
C-414 .0047
C-412 .01
L-404 2.8 µh
C-415 .01
R-408 24K
T-402A
T-402B
C-416 100
C-417 1.5
C-418 1.5
C-419 200
C-420 200
L-405
L-406
R-409 1K
R-410 270
R-411 470K
C-421 .001
C-422 .001
L-107 2.8 µh
V-403 6AU6
R-412 390
C-423 .01
C-424 .0047
C-426 .01
C-425 .01
R-413 39K
T-403A
T-403B
C-427 100
C-428 1.5
C-429 1.2
C-430 100
L-408
L-409
R-414 1K
R-419 62K
R-418 180K
C-431 47
R-415 270
C-432 .01
R-416 10K
C-433 .01
C-436 .001
C-434 .001
V-404 6AL5
R-420 220K
R-417 4.7
C-435 .01
R-142 10K
GAIN
R-109 10K
TO FIRST I.F AMPLIFIER
T-101
S-101
F-101 1A SLO BLO
J-101
V-101 5Y3GT
C-101A,B 20-20 MF
R-102 5K
C-102 A 20 MF
I-101
6.3V TO FIRST I.F AMPLIFIER
C-103 2 MF
CR-101
CR-102
C-104 1 MF
R-103 47K
C-105 1 MF
R-104 5K
R-105 470
C-102B 20 MF
V-102 0A2
R-106 5K
R-107 470
C-102C 20 MF
V-103 0A2
R-108 10K
C-101C 20 MF
B + 150V TO FIRST I.F AMPLIFIER
T-102
C-106 .01
R-110 1.8 MEG
R-111 1MEG
SYNC
SWEEP WIDTH
R-112 500K
C-107 25
V-104 12AU7
R-117 100
R-118 2 MEG
R-115 6.8K
R-114 10K
SWEEP
R-113 15K
H GAIN
R-116 10K
C-108 .047
C-109 .1
V-105 12AT7
R-119 150K
R-120 150K
R-122 33K
R-121 470K
C-110 .1
R-123 470K
H POS
R-124 25K
R-125 100K
R-126 8.2K
R-127 8.2K
R-128 47K
V-106 3RP1A
R-129 300K
ASTIG.
R-132 56K
R-130 50K
INT
R-131 120K
FOCUS
R-133 250K
R-134 330K
C-111 .1
R-135 160K
R-136 5K
R-137 36K
R-138 470K
V POS
C-112 .1
C-113 470
R-139 100K
R-140 100K
C-114 470
V-107 12AT7
R-141 27K
H-17,544
F

NOTES:

1 CAPACITORS WITH NUMBERS LESS THAN ONE ARE MEASURED IN MFD
2 CAPACITORS WITH NUMBERS GREATER THAN ONE ARE MEASURED IN MMFD, UNLESS NOTED
3 TOLERANCES OR RATINGS ON COMPONENTS ARE NOT INDICATED.

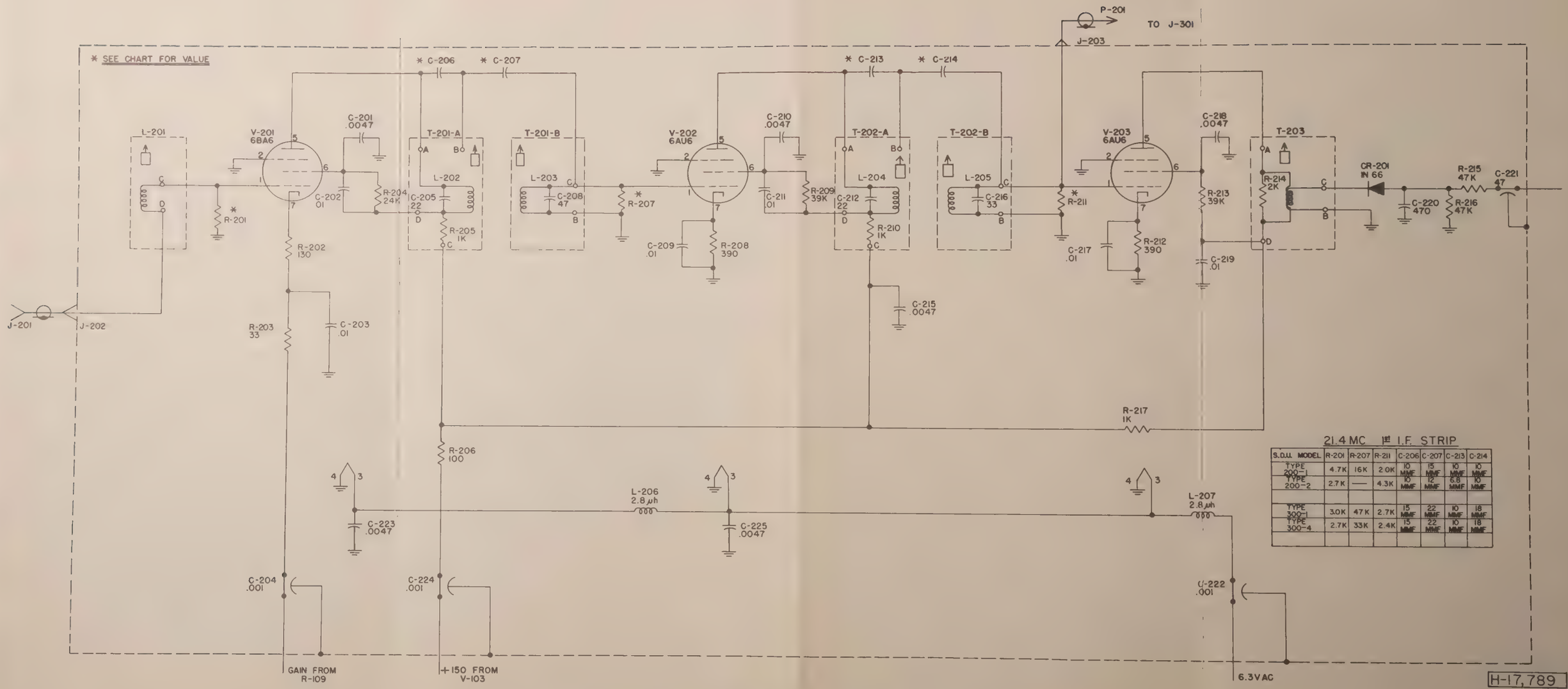
SYMBOLS

○ — OPERATING CONTROL

⊘ — SCREWDRIVER ADJUSTMENT

ARROW DENOTES CW ROTATION

*Figure 11. Schematic Diagram Spectrum Display Unit, Main Chassis, Type 200 and Type 300*

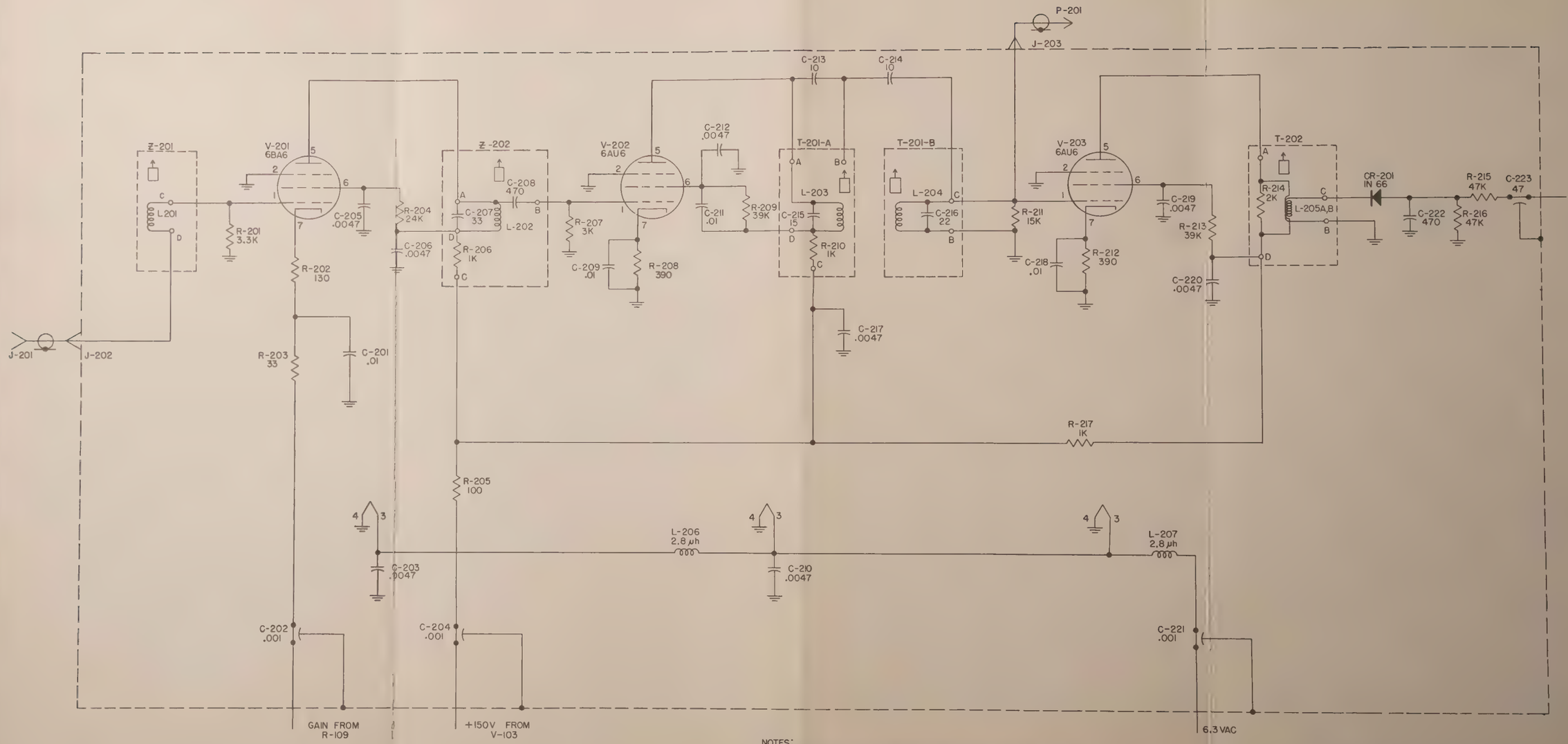



21.4 MC 1st I.F. STRIP

| S.D.U. MODEL | R-201 | R-207 | R-211 | C-206 | C-207 | C-213 | C-214 |
|---|---|---|---|---|---|---|---|
| TYPE 200-1 | 4.7K | 16K | 2.0K | 10 MMF | 15 MMF | 10 MMF | 10 MMF |
| TYPE 200-2 | 2.7K | — | 4.3K | 10 MMF | 12 MMF | 6.8 MMF | 10 MMF |
| | | | | | | | |
| TYPE 300-1 | 3.0K | 47K | 2.7K | 15 MMF | 22 MMF | 10 MMF | 18 MMF |
| TYPE 300-4 | 2.7K | 33K | 2.4K | 15 MMF | 22 MMF | 10 MMF | 18 MMF |
| | | | | | | | |

NOTES:
1. CAPACITORS WITH NUMBERS LESS THAN 1.0 ARE IN MFD.
2. CAPACITORS WITH NUMBERS MORE THAN 1.0 ARE IN MMFD.
3. TOLERANCES AND RATINGS OF COMPONENTS NOT INDICATED.

*Figure 11A. Schematic Diagram 21.4 MC I.F. Amplifier, Spectrum Display Units (Type A)*




NOTES:

1. CAPACITORS WITH NUMBERS LESS THAN 1.0 ARE IN MFD.
2. CAPACITORS WITH NUMBERS MORE THAN 1.0 ARE IN MMFD.
3. TOLERANCES AND RATINGS OF COMPONETS NOT INDICATED.

*Figure 11B. Schematic Diagram 30.0 MC I.F. Amplifier, Spectrum Display Units (Type B)*

# ADDENDA FOR SDU-300-5

The instructions contained herein are entirely applicable for use with the Model SDU-300-5 Spectrum Display Unit with the following exceptions:

(1) Figure 11-B. Schematic Diagram 30.0 MC I.F. Amplifier, Spectrum Display unit is not applicable for use with the SDU-300-5. Use Figure 11-C.

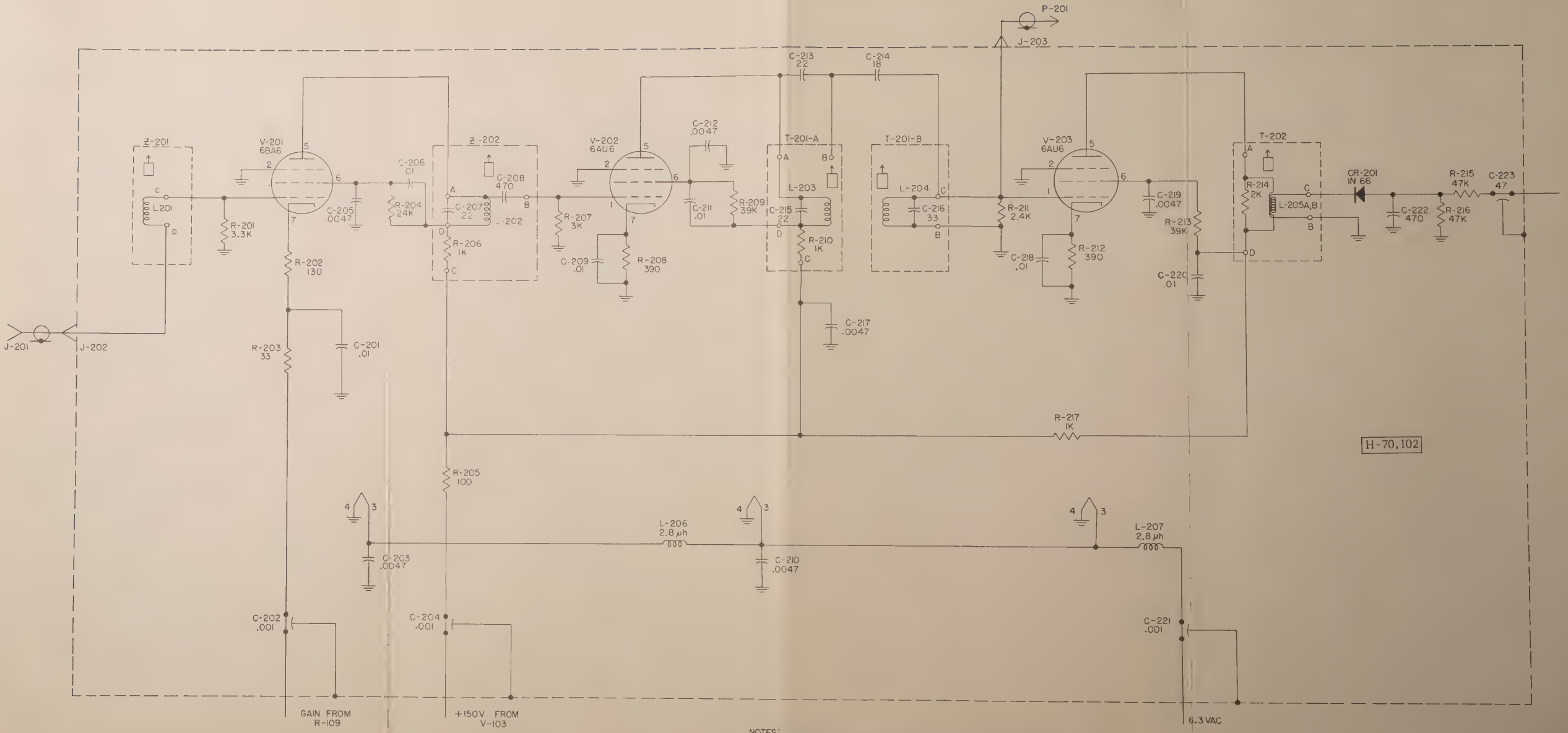
(2) When using the parts list, first refer to the parts list included in this addenda for information on parts used in Model SDU-300-5. If no listing is given in this addenda, then the listing in the main parts list is correct.

(3) The SDU-300-5 Spectrum Display Unit has a 30 MC first IF strip and has been adjusted at the factory to display a total spectrum width of 3.0 megacycles. When using the alignment information contained in this manual, refer only to those sections pertinent to a unit having the specifications listed above.

## ADDENDA TO PARTS LIST
## FOR
## MODEL SDU-300-5
## SPECTRUM DISPLAY UNIT

| *Symbol* | *Description* |
|---|---|
| C-201 | CAPACITOR, CERAMIC DISC: .01 μf, GMV, 500 V, Sprague 29C9B8 |
| C-202 | CAPACITOR, CERAMIC FEEDTHRU: .001 μf, GMV, 500V, Sprague 514C1 |
| C-203 | CAPACITOR, CERAMIC DISC: .0047 μf, MRC, 500V, Sprague 20C8 |
| C-206 | Same as C-201 |
| C-207 | P/O Z-202, not separately replaceable. |
| C-208 | P/O Z-202, not separately replaceable. |
| C-209 | Same as C-201 |
| C-210 | Same as C-203 |
| C-211 | Same as C-201 |
| C-213 | CAPACITOR, CERAMIC DISC: 22 μμf, ±5%, 500 V, Erie NPO-A |
| C-214 | CAPACITOR, CERAMIC DISC: 18 μμf, ±5%, 500 V, Erie NPO-A |
| C-217 | Same as C-203 |
| C-218 | Same as C-201 |
| C-219 | Same as C-203 |
| C-220 | Same as C-201 |
| C-221 | Same as C-202 |

| *Symbol* | *Description* |
|---|---|
| C-222 | CAPACITOR, CERAMIC DISC: 470 $\mu\mu$f, MRC, 500V, Sprague 507C8A |
| C-223 | CAPACITOR, CERAMIC: 47 $\mu\mu$f, ± 20%, 500V, Sprague 514C11A |
| C-301 | CAPACITOR, CERAMIC FEEDTHRU: .001 $\mu\mu$f |
| C-304 | Same as C-223 |
| C-305 | Same as C-201 |
| C-306 | Same as C-203 |
| C-307 | Same as C-202 |
| C-311 | CAPACITOR, VARIABLE: 1.5 - 5.0 $\mu\mu$f, 250V, Hammarlund MAC-5 |
| C-314 | Same as C-201 |
| C-315 | Same as C-201 |
| C-317 | Same as C-203 |
| C-319 | Same as C-201 |
| C-320 | Same as C-201 |
| C-321 | Same as C-203 |
| C-323 | Same as C-201 |
| C-326 | Same as C-202 |
| C-327 | Same as C-202 |
| C-328 | CAPACITOR, CERAMIC FEEDTHRU: 47 $\mu\mu$f, ± 20%, 500V, Sprague 514C11A |
| C-401 | Same as C-201 |
| C-402 | Same as C-203 |
| C-403 | Same as C-201 |
| C-404 | Same as C-202 |
| C-405 | Same as C-201 |
| C-411 | Same as C-201 |
| C-412 | Same as C-201 |
| C-413 | Same as C-201 |
| C-414 | Same as C-203 |
| C-415 | Same as C-201 |
| C-421 | Same as C-202 |
| C-422 | Same as C-202 |
| C-423 | Same as C-201 |




NOTES:

1. CAPACITORS WITH NUMBERS LESS THAN 1.0 ARE IN MFD.
2. CAPACITORS WITH NUMBERS MORE THAN 1.0 ARE IN MMFD.
3. TOLERANCES AND RATINGS OF COMPONETS NOT INDICATED.

*Figure 11C. Schematic Diagram 30 MC I.F. Amplifier, Spectrum Display Units (SDU-300-5)*